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JUNE, 1912

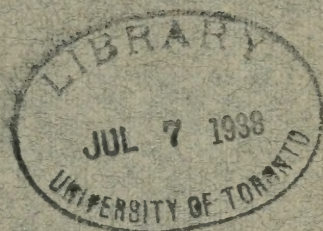
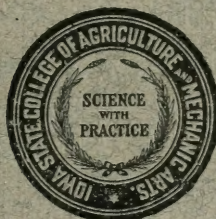
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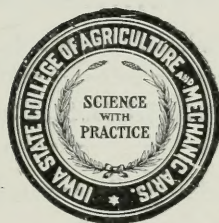
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Associate Professor Economics and Political Science

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CHAPTER I.

A STATISTICAL STUDY OF IOWA POPULATION.

The relation of the population to the food supply on the one hand and the economic progress of a nation or state on the other has been a subject of more or less controversy for at least a century. From the time that Robert Malthus published his epoch-making essays pointing out the laws which control the growth of population as compared with the increase in the supply of food, a group of publicists have sought to analyze the problem of population as an index of social and economic progress. Even as great a writer as John Stuart Mill had much to say about a progressive, stationary or declining state of society, the central thought in his doctrine being the expansion of population as related to the laws of industrial evolution.

This being true the small decline of population in Iowa during the last ten years has become quite naturally a subject of general interest. The causes of this decline go to the very foundation of our political, economic, and social system and therefore are worthy of careful investigation. Before attempting, however, a statement of causes and remedies it is necessary to make a brief statistical survey of the state and national census.

The population of Iowa according to the census of 1910 was 2,224,771 as compared with 2,231,853 in 1900, a decrease of 7.082 during the last decade. This means a loss of three-tenths of one per cent during the same time that the total population of the United States increased twenty-one per cent. The comparison becomes all the more striking when we consider that Iowa is the only state in the Union that has declined in population during this period.

TABLE I.

CENSUS YEAR	Population	INCREASE OVER PRECEDING CENSUS.		Per cent of increase for continental United States
		Number	Per cent	
1910.....	2,224,771	*7,082	*0.3	21.0
1900.....	2,231,853	319,556	16.7	20.7
1890.....	**1,912,297	287,682	17.7	25.5
1880.....	1,624,615	430,595	36.1	30.1
1870.....	1,194,020	519,107	76.9	22.6
1860.....	674,913	482,699	251.1	35.6
1850.....	192,214	149,102	345.8	35.9
1840.....	43,112			

*Decrease.

**Includes population (401) of Indian reservation specially enumerated.

Table I shows the population of Iowa at each Federal Census from 1840 to 1910 inclusive. The increase for each decade and the per cent of increase for Iowa and for continental United States are also indicated.

Iowa became a separate territory by act of Congress in 1838 and when the Federal Census was taken in 1840 had a population of only 43,112. When we consider, however, that the country was not open for white settlement until after the so-called Black Hawk Purchase, in 1833, this represents a substantial colony of pioneers. The territorial period lasted but eight years. Iowa became a state in 1846 and at the next Federal Census, 1850, had a population of 192,214, an increase of 149,102 or 345.8 per cent, while the rate of increase for continental United States was 35.9 per cent. In other words, Iowa increased in population approximately ten times as fast as the nation at large.

The increase of more than a million people during the two following decades in spite of the hard times of 1857 and the Civil War is very significant. The phenomenal growth in population was the logical result of the westward movement of American democracy in quest of cheap lands, a movement which was greatly stimulated by the building of railroads and the era of speculation and high prices which followed the Civil War. It should be noted, however, that the per cent of increase fell from 251.1 in 1860 to 76.9 in 1870. The ratio of increase as compared with the United States as a whole declined rapidly, being about seven to one from 1850 to 1860, and less than four to one from 1860 to 1870 as contrasted with ten to one during the first decade.

The increase during the decade 1870 to 1880 was not so great, as a result of the hard times following the crisis of 1873. The per cent of increase fell to 36.1 as compared with 30.1 for the nation at large. A glance at the table shows that the year 1880 marked a turning point in the growth of Iowa population. Up to that time millions of acres of the best lands had made a rapid increase of population inevitable and that, too, in spite of war, low prices and hard times.

In 1880, the most desirable land had already been taken up. Although the decade 1880-1890 was one of unparalleled commercial prosperity and economic progress along all lines, the growth of Iowa population declined both absolutely and relatively. The increase in numbers was but little more than half of what it had been from 1860 to 1870 and the rate of increase was only 17.7 per cent as compared with 25.5 per cent for the United States as a whole. During the following decade, 1890-1900, the rate of increase for the nation at large was

again more rapid than for our own state, and during the last ten years, as already noted, there has actually been a decline of three-tenths of one per cent for Iowa, as compared with a large increase of twenty-one per cent for the country at large.

The real significance of Table I may be stated in a few words. Prior to 1880, the development of agriculture resting upon a solid foundation of cheap lands and improved transportation facilities made inevitable a phenomenal growth of population. After 1880, the prairies of Iowa, thanks to a group of transcontinental railroad lines, came in competition with vast areas of cheaper land in Canada and the western states; while our own people failed to compensate for this loss by giving proper attention to manufacturing and commerce. The far West is still reaping the harvest made possible by cheap lands while the East with large cities springing up on every hand has become a great manufacturing and commercial center. The lesson which Iowa should learn from this comparison is obvious to every thinking man.

Table II gives the increase or decrease of population by counties for the decades 1840 to 1890 inclusive. It will be noted that at the census of 1840 only eighteen counties had been established in the territory of Iowa, viz., Cedar, Clayton, Clinton, Delaware, Des Moines, Dubuque, Henry, Jackson, Jefferson, Johnson, Jones, Lee, Linn, Louisa, Muscatine, Scott, Van Buren and Washington. Of these, Van Buren ranked first in population with 6,146, Lee, second, with 6,093, and Des Moines, third, with 5,577, all of said counties being located in the southeast corner of the state. Every county bordering the Mississippi is included with the single exception of Allamakee. In other words a glance at the map will indicate to what extent the early settlers were obliged to depend upon water transportation.

When the Federal Census of 1850 was taken, thirty-one counties had been added to the list. All of the original eighteen counties had increased in population, Lee ranking first, with an increase of 12,768, Dubuque, second, with an increase of 7,782, and Des Moines, third, with an increase of 7,411. The tendency of counties to be organized close to navigable streams is still apparent. A history of transportation in Iowa would show the intimate relation which existed between the growth of population and the necessity of providing an outlet to the Eastern market.

In 1860 there were ninety-seven counties in Iowa. Lyon and Osceola are the only ones which do not appear on the list. The coming of the railroad in 1855 had an immediate

POPULATION OF IOWA BY COUNTIES, 1840-1890.

TABLE II.

COUNTY	1840	1850	Increase or Decrease * 1850 over 1840	1860	Increase or Decrease * 1860 over 1850	1870	Increase or Decrease * 1870 over 1860	1880	Increase or Decrease * 1880 over 1870	1890	Increase or Decrease * 1890 over 1880
Total	43,112	192,214	149,102	673,779	481,565	1,194,020	520,241	1,624,615	430,595	1,911,896	237,281
Adair.....				984		3,982	2,998	11,667	7,685	14,584	2,867
Adams.....				1,533		4,614	3,081	11,888	7,274	12,292	4,404
Allamakee....		777		12,231	11,454	17,868	5,637	19,791	1,923	17,967	-1,884
Apanoose....		3,131		11,918	8,787	16,455	4,568	16,636	180	18,961	2,325
Audubon.....				451		1,212	758	7,448	6,236	12,412	4,964
Benton.....		672		8,495	7,823	22,454	13,959	24,888	2,434	24,178	-710
Black Hawk..		135		8,226	8,091	21,706	13,480	23,913	2,207	24,219	1,306
Boone.....		735		4,232	3,497	14,584	10,352	20,898	6,254	23,772	2,924
Bremer.....				4,910		12,528	7,618	14,081	1,553	14,680	549
Buchanan....		517		7,904	7,387	17,034	9,130	18,546	1,512	18,997	451
Buena Vista..				57		1,585	1,528	7,537	5,952	13,548	6,011
Butler.....				3,723		9,951	6,228	14,293	4,342	15,463	1,170
Calhoun.....				147		1,602	1,455	5,995	3,993	13,107	7,512
Carrroll.....				281		2,451	2,170	12,351	9,900	18,828	6,477
Cass.....	1,253	3,941	2,688	1,612	5,464	3,852	16,943	16,943	11,479	19,645	2,702
Cedar.....				12,937	8,996	19,731	6,794	18,936	7,795	18,233	-853
Cerro Gordo..				940		4,722	3,782	11,461	6,739	14,864	3,403
Cherokee....				58		1,967	1,909	8,240	6,273	15,659	7,419
Chickasaw...		79		4,331	5,346	10,180	5,849	14,534	4,354	15,019	485
Clarke.....				5,427		8,735	3,308	11,513	2,778	11,332	-181
Clay.....				52		1,523	1,471	4,248	2,725	9,309	5,061
Clayton.....	1,101	3,873	2,772	20,703	16,830	27,771	7,068	28,829	1,058	26,733	-2,096
Clinton.....	821	2,822	2,001	18,925	16,103	35,357	16,432	36,763	1,406	41,199	4,436
Crawford....				383		2,530	2,147	12,413	9,883	18,894	6,481
Dallas.....		854		5,244	4,390	12,019	6,775	18,746	6,727	20,479	1,733
Davis.....				13,762	6,498	15,565	1,803	16,468	903	15,258	-1,210
Decatur.....		995		8,670	7,705	12,018	3,348	15,336	3,318	15,643	307
Delaware....	168	1,759	1,591	11,023	9,264	17,432	6,409	17,950	518	17,349	-601
Des Moines...	5,577	12,988	7,411	19,583	6,595	27,256	7,673	33,099	5,843	35,324	2,225
Dickinson...				180		1,389	1,299	1,901	512	4,328	2,427
Dubuque.....	3,059	10,841	7,782	31,083	20,242	38,969	7,886	42,996	4,027	49,848	6,852
Emmet.....		825		105	-720	1,392	1,287	1,550	158	4,274	2,724
Fayette.....		1,244		12,019	10,775	16,973	4,954	22,258	5,285	23,141	883
Floyd.....				3,744		10,768	7,024	14,677	3,990	15,424	747
Franklin....				1,309		4,788	3,429	10,249	5,511	12,871	2,622
Fremont.....				5,069		11,174	6,105	17,652	6,478	16,842	-810
Greene.....				1,374		4,627	12,727	12,727	8,100	15,797	3,070
Grundy.....				793		6,399	5,606	12,639	6,240	13,215	576

*Minus sign (-) denotes decrease.

TABLE II—Continued.

Guthrie.....				3,058	7,961	4,003	14,394	7,333	17,380	2,086
Hamilton.....				1,699	6,055	4,356	11,252	5,197	15,319	4,067
Hancock.....				179	999	820	3,453	2,454	7,621	1,196
Hardin.....				5,440	13,684	8,244	17,807	4,123	19,003	4,707
Harrison.....				3,620	8,931	5,311	16,649	7,718	21,356	—2,091
Henry.....	3,772	8,707	4,935	18,677	21,463	2,786	20,986	—477	18,895	347
Howard.....				3,167	6,282	3,115	10,837	4,555	11,182	6,495
Humboldt.....				332	2,596	2,264	5,341	2,745	9,836	4,323
Iida.....				43	226	183	4,382	4,156	10,705	6,923
Iowa.....	8,029	8,222		43	226	183	4,382	4,156	10,705	6,923
Jackson.....	1,411	7,210	5,799	18,482	16,644	8,615	19,221	2,577	18,279	—651
Jasper.....				1,280	22,116	2,234	23,771	1,152	22,771	—1,000
Jefferson.....	2,773	9,904	7,131	15,030	8,602	2,294	25,963	3,847	24,943	—1,020
Johnson.....	4,472	2,981	17,335	13,063	17,839	2,809	17,469	—370	15,184	—2,285
Jones.....	1,491	3,007	2,536	13,299	24,898	7,363	25,429	531	20,233	—2,347
Keokuk.....	471	4,822		13,271	19,434	6,432	21,052	1,824	23,862	2,604
Kearney.....				416	3,351	2,935	6,178	2,827	13,120	6,942
Kearney.....	6,093	18,861	12,768	28,987	37,210	8,223	34,859	—2,351	37,715	2,855
Le... ..	1,373	4,071	3,012	10,276	31,080	12,144	37,237	6,157	45,303	8,065
Lima.....				5,764	10,388	2,601	13,142	265	11,873	—1,263
Louis.....				471	921	4,624	14,530	4,142	14,563	33
Lucas.....				7,339	13,884	6,545	17,224	1,747	8,680	6,712
Lyon.....	1,179	5,080	8,811	14,800	22,598	7,708	25,202	3,340	15,977	—1,247
Madison.....	5,482	16,780	11,208	16,780	24,436	7,656	25,111	2,694	28,805	3,603
Manaska.....	335	4,462	5,677	6,015	17,576	11,561	23,752	6,775	23,058	—2,053
Marion.....				3,408	9,718	4,256	14,137	5,419	25,812	2,090
Marshall.....				3,408	9,718	4,256	14,137	5,419	25,812	2,090
Mills.....				3,408	9,718	4,256	14,137	5,419	25,812	2,090
Mitchell.....				3,408	9,718	4,256	14,137	5,419	25,812	2,090
Monroe.....	2,884	8,615	5,726	8,615	12,724	2,826	14,173	4,781	13,200	—1,064
Montgomery.....				8,615	12,724	2,826	14,173	4,781	13,200	—1,064
Muscataine.....	1,942	5,731	3,789	16,352	21,088	5,356	23,170	9,095	15,848	5,469
O'Brien.....				8	715	707	2,219	3,440	13,600	8,903
Oscola.....	551			4,418	9,975	5,557	19,667	3,602	21,341	3,555
Page.....				132	1,336	1,204	4,131	2,735	9,318	1,074
Palo Alto.....				138	2,199	2,001	8,566	3,367	19,568	5,181
Plymouth.....				103	1,446	1,343	3,713	2,267	9,563	11,002
Pocahontas.....				11,612	27,857	16,245	42,395	14,538	69,410	5,840
Polk.....	4,513	7,828	—2,869	4,959	16,893	11,934	39,350	22,957	47,430	23,015
Pottawattamie.....	615			5,661	15,381	9,920	18,036	3,365	18,304	7,980
Poweshiek.....				2,922	5,691	2,769	12,085	6,394	13,586	—342
Ringold.....				246	1,411	1,165	8,774	7,363	14,522	1,471
Sac.....				25,020	38,590	12,679	41,266	2,957	43,161	5,745
Scott.....	2,140	5,986		817	2,540	1,723	12,696	10,156	17,611	1,898
Shelby.....				10	576	566	5,426	5,426	12,044	4,915
Sioux.....				4,051	11,651	7,600	16,905	5,255	18,127	12,044
Story.....				4,051	11,651	7,600	16,905	5,255	18,127	1,221

*Minus sign (—) denotes decrease.

TABLE II—Continued.

	S								
Tana.....	204	.....	5,277	10,131	10,846	21,585	5,454	21,651	66
Taylor.....	.....	.....	3,386	6,989	3,390	15,355	8,046	16,384	749
Union.....	.....	.....	.....	5,986	3,974	14,980	8,994	16,900	1,920
Van Buren.....	6,124	.....	.....	17,672	505	17,043	-629	16,253	-790
Wapello.....	8,471	.....	4,807	22,346	7,875	25,285	2,039	30,426	5,141
Warren.....	961	.....	6,000	17,989	7,713	19,578	1,598	18,269	-1,309
Washington.....	1,594	.....	9,206	18,952	4,730	29,374	1,422	18,468	-1,906
Wayne.....	4,957	3,363	9,265	11,287	4,880	16,127	4,840	15,670	-457
Wesley.....	340	.....	6,058	10,481	7,984	15,951	5,467	21,582	5,031
Wesley.....	.....	.....	.....	1,562	1,394	4,917	3,355	7,325	2,408
Winneshaw.....	.....	.....	.....	23,570	9,628	23,938	368	22,528	-1,410
Woodbury.....	546	.....	13,396	6,172	5,004	14,996	8,824	55,632	40,636
Worth.....	.....	.....	.....	2,892	2,136	7,933	5,061	9,247	1,294
Wright.....	.....	.....	.....	2,392	1,739	5,092	2,670	12,057	6,995

*Minus sign (—) denotes decrease.

effect upon settlement. As already noted in Table I, the population of Iowa during the decade under consideration increased nearly half a million. Only two counties show a decrease in population, Emmet, which had 825 in 1850 and only 105 in 1860; and Pottawattamie which had 7,828 in 1850 and 4,959 in 1860. This nominal decrease of 720 in Emmet and 2,869 in Pottawattamie is obviously the result of changes in the boundary lines caused by the formation of new counties. On the whole there was a remarkable increase of population well distributed over the state.

The decade of the Civil War closed with an increase of more than half a million, or in other words the population of Iowa had nearly doubled. The greater part of this phenomenal increase, however, came from 1865 to 1870 as a logical result of inflated currency, high prices, speculation and the rapid extension of railroad lines. Lyon county was added to the list, and every one of the ninety-seven counties organized prior to 1860 increased in population. Clinton county was in the lead with an increase of 16,432. Polk followed with an increase of 16,245 and others having an increase of more than ten thousand were Benton, Black Hawk, Boone, Linn, Marshall, Pottawattamie, Scott and Tama.

The Federal Census of 1880 also shows a rapid increase of population in practically all sections of the state. Only five counties declined in population, the decrease being as follows: Cedar, 795, Henry, 477, Jefferson, 370, Lee, 2,351, and Van Buren, 629, all located in the eastern and southeastern part of the state. It will also be noted that Osceola county is added to the list making the full ninety-nine counties which we have at the present time.

The census of 1890 continued to show a substantial increase for the state at large, but at the same time twenty-seven counties declined in population. These counties were the following: Allamakee, Benton, Cedar, Clarke, Clayton, Davis, Delaware, Fremont, Henry, Iowa, Jackson, Jasper, Jefferson, Johnson, Jones, Louisa, Madison, Marion, Mitchell, Monroe, Montgomery, Poweshiek, Van Buren, Warren, Washington, Wayne, and Winneshiek. It is an interesting fact that not one of these counties is located north and west of the southeast corner of Polk county. In contrast with the former census only three counties increased in population more than 10,000, Woodbury, with the unusual increase of 40,636, Polk, with an increase of 23,015 and Plymouth, with an increase of 11,002. The large increase of Woodbury and Plymouth and a very substantial increase for Lyon, Sioux, Osceola, O'Brien, Cherokee, Ida, Clay and Buena Vista is explained by the

rapid advance of settlement to the northwest portion of the state during the decade under consideration.

Table III gives the population by counties for the Federal Censuses of 1890, 1900 and 1910, also for the State Census of 1905. The number and percentage of increase are both given in the Federal Census and the percentage of increase is given in the State Census of 1905.

Comparing the two decades ending 1900 and 1910, respectively, it will be observed that only one county, Woodbury, decreased in population during the former period while seventy-one counties decreased in population during the latter. The increase of population for the decade 1890-1900 was quite uniform throughout the state, only three counties, Linn, Polk and Webster showing an increase of more than ten thousand. The percentage of increase, however, was very high, especially in some of the northwestern counties, Emmet ranking first with 132.5 per cent, Dickinson, second, with 84.7 per cent and Hancock, third, with 80.4 per cent.

While the last Federal Census shows that seventy-one counties in Iowa have decreased in population, it is necessary to investigate the State Census of 1905 in order to ascertain whether the decrease took place largely in the first half or last half of the decade. In other words, it is possible for a county to show a decrease in population for the decade, considered as a whole, while this same county may have enjoyed a substantial increase during the last five years.

In this connection, it will be observed that the State Census of 1905 shows that seventy-six counties had actually decreased in population, which means that only twenty-three had increased. The percentage of decrease is as follows, for counties well distributed over the state: Adams, 9.8, Chickasaw, 6.5, Davis, 8.7, Fremont, 12.2, Ida, 5.5, Kossuth, 3.3, Mills, 12, Ringgold, 8.9, Winnebago, 5.3, and Wright, 3.3. The percentage of increase in other counties is as follows: Monroe, 35.5, Polk, 17.3, Blackhawk, 13, and Woodbury, 11.4, the increase in each case being due either to the coal mining industry or the growth of cities.

It is thus apparent that the greater part of the decline in population during the last decade took place during the years 1900-1905. While seventy-six counties declined in population during the five-year period ending 1905, only seventy-one counties declined in population for the decade as a whole and sixty-two for the five-year period ending 1910. The total decrease in population for the state at large was 21,803 between 1900 and 1905, while the decrease for the decade ending 1910 was only 7,082, leaving a net increase of popula-

POPULATION OF IOWA BY COUNTIES, 1890-1910.

TABLE III.

COUNTY	Population 1890	Population 1900	Increase or Decrease *		Increase of Population 1905 over 1900		Increase or Decrease 1910 over 1900		Increase* or Decrease 1910 over 1905	
			Number	Per cent	Per cent	Number	Per cent	Number	Per cent	Number
Total.	1,912,297	2,231,853	319,556	16.7		2,210,150	- 0.9	2,224,771	- 0.3	14,721
Adair	14,534	15,192	1,658	11.4		15,110	- 6.7	14,420	- 1,772	- 690
Adams	13,601	13,601	1,300	10.6		12,362	- 9.8	11,420	- 938	- 1,264
Allamakee	17,907	18,711	804	4.5		18,222	- 2.6	17,328	- 983	- 1,264
Ansonia	18,961	25,927	6,966	36.7		27,193	4.9	28,701	1,508	1,508
Arnold	12,412	13,626	1,214	9.8		12,935	- 5.1	12,671	- 264	- 266
Benton	21,178	25,177	999	4.1		24,117	- 4.2	23,136	- 981	- 981
Black Hawk	24,219	32,399	8,180	33.8		36,617	13.0	41,865	5,248	5,248
Boone	23,772	28,240	4,468	18.6		27,604	- 2.1	27,626	22	22
Bremer	14,630	16,305	1,675	11.4		15,973	- 2.0	15,815	- 158	- 130
Buchanan	18,997	21,427	2,430	12.8		19,134	- 10.4	19,748	614	614
Buena Vista	13,548	16,975	3,427	25.3		15,907	- 6.3	15,981	74	74
Butler	17,955	17,955	4,492	25.0		17,636	- 1.8	17,119	- 517	- 517
Calhoun	13,107	18,569	5,462	41.7		17,308	- 6.9	17,690	382	382
Cass	18,825	21,319	1,494	7.9		20,312	- 4.9	20,117	- 195	- 195
Cedar	19,445	21,274	1,829	8.3		20,222	- 4.4	19,047	- 1,175	- 1,175
Cerro Gordo	18,253	19,371	1,118	6.1		18,368	- 5.2	17,765	- 603	- 603
Cherokee	14,864	20,672	5,808	39.1		21,534	4.2	25,011	3,477	3,477
Chickasaw	15,019	16,570	911	5.8		15,962	- 3.7	16,741	779	779
Clarke	11,332	12,440	1,108	9.8		15,928	6.5	16,741	813	813
Clatsop	26,733	27,730	1,017	3.8		11,639	- 6.4	10,736	- 903	- 903
Clinton	41,199	43,832	2,633	6.4		12,711	- 5.2	12,766	55	55
Crawford	18,894	21,685	2,791	14.8		23,734	3.7	23,576	- 158	- 158
Dallas	20,479	23,058	2,579	12.6		42,793	1.1	45,394	2,601	2,601
Davis	15,258	18,115	2,857	18.8		21,030	3.2	20,041	- 989	- 989
Dea	15,613	18,115	2,472	15.8		23,035	1.1	23,028	- 7	- 7
Delaware	17,349	19,185	1,836	10.6		14,296	- 8.7	13,315	- 981	- 981
Des Moines	35,924	35,989	665	1.9		17,044	- 5.5	16,347	- 697	- 697
Des Moines	4,328	7,995	3,667	84.7		18,761	2.3	17,888	- 873	- 873
Dickinson	49,848	56,403	6,555	13.1		37,472	4.1	36,145	- 1,327	- 1,327
Dubucque	9,936	13,215	3,279	33.0		8,130	1.7	8,137	7	7
Emmett	23,141	23,141	5,632	24.3		61,471	8.9	57,450	- 4,021	- 4,021
Fayette	15,121	17,734	2,613	17.3		19,105	1.7	19,816	711	711
Floyd	12,871	14,906	2,035	15.8		28,552	4.3	27,919	- 633	- 633
Franklin	16,812	18,546	1,734	10.3		16,779	- 5.4	17,119	340	340
Fremont	13,297	15,829	2,532	19.0		14,505	- 2.7	14,780	275	275
Greene	13,297	15,829	2,532	19.0		16,279	- 12.2	15,023	- 1,256	- 1,256
Grundy	13,215	13,757	542	4.1		16,084	- 9.1	16,023	- 61	- 61
						13,607	- 1.1	13,574	- 33	- 33

* Minus sign (-) denotes decrease.

TABLE III—Continued.

Guthrie.....	17,383	18,724	1,349	7 8	18,013	— 3 8	17,374	—1,355	7 2	—639
Hamilton.....	15,319	19,514	4,195	27 4	19,381	— 7	19,242	—272	1 3	—139
Hancock.....	13,752	13,752	6,151	83 4	12,987	— 5 6	12,731	—1,021	7 3	—256
Hardin.....	19,003	22,734	3,731	19 9	21,836	— 4 1	20,921	—1,873	8 2	—495
Harrison.....	25,597	26,022	4,241	16 0	23,762	— 7 2	23,162	—2,435	9 7	—600
Henry.....	18,895	20,022	1,127	16 0	17,722	—10 4	18,640	—1,382	6 9	—918
Howard.....	14,512	13,330	3,330	29 8	13,323	— 6 8	12,920	—1,352	10 9	—603
Hunboldt.....	9,836	12,667	2,831	28 8	13,523	— 4 8	12,182	— 485	3 8	—60
Iola.....	10,705	12,327	1,622	15 2	11,646	— 5 5	11,236	—1,031	8 8	—350
Iowa.....	18,270	19,544	1,274	7 0	18,977	— 2 9	18,400	—1,135	5 8	—565
Jackson.....	22,771	23,615	844	3 7	22,210	— 5 9	21,258	—2,357	9 9	—952
Jasper.....	21,943	29,976	2,033	8 2	27,156	— 7	27,034	— 58	0 2	—122
Jefferson.....	15,184	17,437	2,253	14 8	16,493	— 5 4	15,931	—1,486	8 5	—542
Johnson.....	24,817	24,817	1,735	7 5	24,683	— 5	25,914	1,097	4 4	1,231
Jones.....	20,233	21,954	1,721	8 5	20,427	— 6 9	19,050	—2,904	13 2	—1,377
Keweenaw.....	23,862	21,979	1,117	4 7	22,667	— 3 2	21,160	—3,819	11 2	—1,597
Kossuth.....	22,720	9,600	1,117	73 2	21,963	— 3 3	21,971	—749	3 3	— 8
Lee.....	37,715	39,719	2,004	5 3	38,096	— 4 3	36,702	—2,017	7 7	—1,304
Linn.....	45,303	55,392	1,089	22 3	57,362	— 3 5	60,720	5,325	9 6	3,358
Louis.....	11,873	13,516	1,643	13 8	12,893	— 4 6	12,555	—661	4 9	— 38
Lucas.....	16,125	13,516	1,593	10 7	15,599	— 3 3	13,462	—2,681	16 5	2,137
Lyon.....	13,165	14,883	4,483	51 7	13,494	— 2 6	14,621	1,459	11 0	1,130
Madison.....	15,377	17,710	1,733	10 8	16,707	— 5 6	15,021	—2,090	11 8	—1,086
Malaska.....	28,805	34,273	5,468	19 0	31,430	— 8 4	29,800	—2,433	12 8	—1,570
Marion.....	24,159	24,159	1,101	4 8	24,107	— 2	22,905	—1,164	4 2	—1,112
Marshall.....	26,991	26,991	4,149	16 1	28,495	— 5 0	30,279	—288	0 9	1,784
Mills.....	14,548	16,761	2,216	15 2	15,650	—12 0	15,811	—953	5 6	761
Mitchell.....	14,915	17,980	1,617	15 2	14,183	— 4 9	13,435	—1,481	9 9	—748
Monroe.....	17,980	3,465	3,465	23 9	16,857	— 5 9	16,633	—1,347	7 4	—224
Monterey.....	17,803	1,955	4,319	31 6	24,376	— 35 5	25,429	7,444	41 3	1,053
Muscataine.....	25,242	17,903	3,738	15 3	17,021	— 4 4	16,694	—1,199	6 7	—417
O'Brien.....	16,985	3,925	3,925	30 1	28,171	— 1 6	24,595	1,263	4 4	1,334
Ogocla.....	8,725	3,151	56 5	5	16,710	— 1 6	17,262	277	1 6	552
Osage.....	21,341	2,846	3,151	56 5	8,827	— 1 2	8,966	271	2 6	129
Pack.....	21,341	2,846	3,151	56 5	23,606	— 2 4	21,002	—1,85	0 7	396
Palo Alto.....	14,354	5,936	54 0	13 3	14,132	— 1 5	13,845	—509	3 5	—287
Plymouth.....	22,201	2,611	5,936	13 3	22,818	— 2 7	23,129	929	4 1	311
Pocahontas.....	15,339	5,786	69 6	17 3	14,670	— 4 3	14,808	—531	3 4	129
Polk.....	82,621	17,214	26 3	26 3	96,950	—17 3	110,438	27,814	33 6	13,488
Pottawattamie.....	47,430	6,906	14 0	4 5	51,807	— 4 5	55,882	1,496	0 7	3,965
Poweshieck.....	19,414	1,020	5 5	— 8 9	19,445	— 2	13,589	—1,75	0 8	144
Ringgold.....	13,556	1,769	13 0	— 3 3	13,955	— 3 3	12,904	—2,421	15 8	—1,051
Sac.....	14,522	17,639	3,117	21 5	17,065	— 8 4	16,535	—1,084	6 1	510
Scott.....	43,161	51,558	8,394	19 4	55,910	— 8 4	60,000	8,442	16 4	4,090
Shelby.....	17,911	17,932	321	1 8	17,097	— 4 6	16,552	—1,380	— 7 8	—545
Sioux.....	18,370	23,337	4,967	27 0	24,021	— 2 9	25,248	—1,911	8 2	1,227
Story.....	18,127	23,159	5,032	27 8	23,660	— 2 1	24,083	924	3 9	423

*Minus sign (—) denotes decrease.

TABLE III—Continued.

Tama	21,651	24,585	2,549	11 8	23,201	— 5 2	22,156	— 2,429	— 9 8	— 1,125
Taylor	16,384	18,784	2,400	14 6	17,021	— 9 4	16,312	— 2,472	— 13 1	— 709
Union	16,900	19,628	3,028	17 9	18,666	— 6 3	16,616	— 3,312	— 16 6	— 2,650
Van Buren	16,253	17,354	1,101	6 8	15,665	— 4 5	15,020	— 2,331	— 13 1	— 1,545
Wayne	30,424	35,426	5,000	16 3	33,524	— 3 1	37,743	— 2,317	— 6 5	— 1,219
Warren	18,269	20,376	2,107	11 5	20,355	— 3 4	18,194	— 2,182	— 17 0	— 1,581
Washington	18,168	20,718	2,250	12 2	20,116	— 2 4	19,325	— 795	— 3 8	— 1,011
Wayne	15,570	17,404	1,821	11 6	16,316	— 3 3	16,184	— 1,507	— 7 4	— 721
Weister	24,582	37,457	10,175	47 4	33,425	— 5 3	34,329	2,872	— 9 0	1,204
Winnipeg	22,923	12,725	5,100	75 7	12,043	— 5 3	11,914	— 811	— 6 3	— 129
Winnipeg	22,328	23,751	1,205	5 3	23,107	— 2 6	21,729	— 2,002	— 8 4	— 1,518
Woodbury	53,632	54,610	— 1,022	— 1 8	60,839	— 11 4	67,616	13,006	— 23 8	6,757
Worth	9,247	10,887	1,640	17 7	10,685	— 2 2	9,930	— 337	— 8 6	— 685
Wright	12,057	18,227	6,170	51 2	17,629	— 3 3	17,951	— 276	— 1 4	— 322

*Minus sign (—) denotes decrease.

tion for the state at large of 14,721 for the five-year period ending 1910. A comparative study of the Federal and State Census therefore reveals the fact that the decrease, considering the state as a whole, took place during the first half of the decade.

A more critical study of Table III shows other interesting facts when we compare the decade as a whole with each five-year period. The following counties, Cherokee, Clinton, Johnson, Dallas, Marshall, Muscatine, O'Brien and Pottawattamie decreased in population from 1900 to 1905, but increased for the decade ending 1910. On the other hand, Shelby, Carroll and Emmet increased from 1900 to 1905 and decreased for the ten-year period. Contrasting the decade as a whole with the five years ending 1910, we find that Boone, Buchanan, Buena Vista, Clay, Floyd, Franklin, Henry, Humboldt, Kosuth, Mills, Page, Pocahontas and Wright counties decreased during the ten-year period, but increased when compared with the State Census of 1905. On the other hand, Des Moines, Dubuque and Jasper counties decreased for the five-year period ending 1910, but increased for the decade as a whole. In other words, a comparative study of the State and Federal Census makes it possible to reach no definite conclusion aside from the fact that the state has enjoyed a small increase of population during the last five years due to the growth of towns and cities.

Concluding our study of Tables I, II and III, it is evident

TABLE IV. URBAN AND RURAL POPULATION.

COUNTY	Increase Population	City Increase	County Decrease	County Increase
Appanoose.....	2,774	1,680		1,094
Black Hawk.....	12,466	14,113	1,647	
Cerro Gordo.....	4,359	4,484	125	
Cherokee.....	171	1,019	848	
Clinton.....	1,562	2,879	1,317	
Dallas.....	570	644	74	
Des Moines.....	156	1,123	967	
Dickinson.....	142	90		52
Dubuque.....	1,047	2,197	1,150	
Jasper.....	58	934	876	
Johnson.....	1,097	2,104	1,007	
Linn.....	5,328	7,155	1,827	
Lyon.....	1,459	239		1,220
Marshall.....	288	1,830	1,542	
Monroe.....	7,444	2,080		5,364
Muscatine.....	1,263	2,105	842	
O'Brien.....	277	659	382	
Osceola.....	231	41		190
Plymouth.....	920	11		909
Polk.....	27,814	24,229		3,585
Pottawattamie.....	1,496	3,490	1,994	
Poweshiek.....	175	1,176	1,001	
Scott.....	8,442	7,774		708
Sioux.....	1,911	297		1,614
Story.....	924	1,801	877	
Wapello.....	2,317	3,815	1,498	
Webster.....	2,872	3,381	509	
Woodbury.....	13,006	14,717	1,711	

that the tendency to increase was practically universal down to 1880. Between 1880 and 1890, a considerable group of counties decreased in population, but during the following decade, 1890-1900, only one county decreased. While the last decade therefore stands out in marked contrast to the one just preceding, we have the same conditions in a more striking degree that existed from 1880 to 1890 and that have existed and do exist in a great many other states.

The fact is that before we can understand the true meaning of the data contained in Tables I, II, and III, it is necessary to make a comparative study of urban and rural population. A glance at Table IV, which gives a list of the twenty-eight counties that have increased during the last decade shows that in almost every case said increase has been the result of the growth of urban population. In other words, practically all of these counties show an actual decline in rural population. The second column of the table gives the increase in population of only one city. It is an interesting fact that after subtracting the increase for one city we find that there are only nine counties in Iowa that have increased in population.

Of these counties, Appanoose has a total increase of 2,774, but three cities, Centerville, Mystic and Cincinnati show an increase of 2,728. When we consider that three towns have been incorporated since 1900 with a total population of 1,366, it is evident that the rural districts, considered as a unit, have actually declined in population. In fact, several of the rural townships declined all the way from forty or fifty up to one hundred and sixteen as shown by a study of the census returns by minor civil divisions.

Dickinson county with a total increase of 142 for the decade has three towns, Milford, Terrill and Arnold's Park with an increase of 148, a number of rural townships which have declined in population and one where the decrease has been 141. Lyon county with a total increase of 1,459 has four towns, Rock Rapids, George, Inwood and Doon with an increase of 605 and has townships which have decreased, but the county as a whole has uniformly increased in population both in the towns and rural districts.

In Monroe county we note at once the effect of the coal mining industry. The county shows a total increase of 7,444, but three townships, Troy, Bluff Creek and Guilford, have an increase of 7,353. In contrast with the large increase for certain coal mining centers, it will be observed that a number of rural townships, depending upon agriculture, have declined

in population. In fact, one township, Franklin, has decreased 159 during the last ten years.

Osceola, Plymouth and Sioux all have enjoyed a uniform increase both in the towns and rural districts although each of the counties named has townships that have declined in population. In Osceola and Plymouth the increase outside of the towns, however, has been very small, in fact, almost a negligible quantity. The large increase of 27,814 for Polk and 8,442 for Scott county is largely explained by the cities of Des Moines and Davenport. The city of Des Moines increased 24,229 and the city of Davenport, 7,774. In both counties many of the rural townships reveal a substantial decline in population.

Concluding our comparative study of population by counties it is an interesting fact that out of the ninety-nine counties in Iowa only four, Lyon, Osceola, Plymouth and Sioux have increased in the rural districts while in the remaining twenty-four that show a total increase, the increase is the logical result of the growth of towns and cities. It is therefore apparent that the decline in rural population has been practically universal throughout the state for the period 1900-1910.

Turning now to a more detailed study of rural as contrasted with urban population we find that the Federal Census employs two distinct methods of comparison. The first method bases the classification upon the population of each place as it existed at each census. In other words, cities of 10,000 and over in 1910 are compared with cities of 10,000 and over in 1900, which means that the same cities are not compared for the two periods. This method is valuable for certain purposes but open to criticism in other respects. It enables us to determine group by group certain tendencies in the movement of population. The student, however, cannot ascertain by this method of growth of population within a certain class or group. This being true, it is not possible to form an accurate judgment regarding the increase or decrease of rural population considered as a distinct class.

Table V taken directly from the Federal Census Report illustrates this group method of comparison. It will be observed that the so-called urban territory included sixty-nine cities in 1910, seventy in 1900 and only forty-six in 1890. We find 768 cities and towns of less than 2,500 inhabitants in 1910, 614 in 1900 and only 416 in 1890. It is therefore obvious that following the group method we are comparing sixteen cities of 10,000 to 50,000 inhabitants in 1910 with thirteen cities of the same population in 1900 and ten in 1890.

TABLE V. URBAN AND RURAL POPULATION 1890-1910.

CLASS OF PLACES.	1910		1900		1890		PER CENT OF TOTAL POPULATION.		
	Number of places	Population	Number of places	Population	Number of places	Population	1910.	1900	1890
Total population.....		2,224,771		2,231,853		*1,912,297	100.0	100.0	100.0
<i>Urban territory.</i>	63	689,054	70	572,386	46	405,764	30.6	25.5	21.2
Cities and towns of—									
50,000 inhabitants or more.....	1	86,368	1	62,130	1	50,093	3.9	2.8	2.6
25,000 to 50,000 inhabitants.....	7	243,723	5	156,120	3	94,989	11.0	7.0	5.0
10,000 to 25,000 inhabitants.....	9	137,107	8	128,096	7	115,234	6.2	5.8	6.0
5,000 to 10,000 inhabitants.....	9	59,402	10	70,618	8	56,582	2.7	3.2	3.0
2,500 to 5,000 inhabitants.....	43	153,454	46	154,413	27	88,866	6.9	6.9	4.6
<i>Rural territory.</i>		1,544,217		1,659,467		*1,506,533	69.4	74.5	78.8
Cities and towns of less than 2,500 inhabitants.....	768	438,715	614	400,732	416	296,498	19.7	18.0	15.5
Other rural territory.....		1,105,502		1,258,735		*1,210,035	49.7	56.4	63.3

*Includes population (401) of Indian reservation specially enumerated.

Defining rural territory as including all cities and towns of less than 2,500 inhabitants, it appears that 69.4 per cent of the population was rural in 1910, 74.4 per cent in 1900 and 78.8 per cent in 1890. Eliminating cities and towns of less than 2,500 inhabitants, we find that what the Census calls, "other rural territory" contained 63.3 per cent of the total population in 1890, 56.4 per cent in 1900 and only 49.7 in 1910. In other words, the Federal Census of 1910 reveals the fact that for the first time in the history of Iowa, rural territory outside of all incorporated places contained less than half the population of the state.

Table V also shows in a general way the decline in rural population during the last ten years, in fact, during the last twenty-year period when considered as a unit. It appears that strictly rural territory had a population of 1,210,035 in 1890, which increased to 1,258,675 in 1900, only to decline again to 1,106,002 in 1910. In other words the statistics give the impression that the rural districts increased 48,640 from 1890-1900 and decreased 152,673 from 1900-1910, which means that the total decrease for the twenty-year period was 104,033. This conclusion, however, is not strictly accurate because the Federal Census of 1900 included a large group of unincorporated places which are arbitrarily transferred by this method of classification to the group classed as cities and towns of less than 2,500 inhabitants in the census of 1910. While it is impossible to determine the exact rural population for the reason that the census in this respect is obviously defective a more nearly correct estimate is made possible by a study of the following tables.

Table VI also taken from the Federal Census Report gives a classification on the basis of the second method of comparison referred to above. In other words a comparison is made of places having 25,000 or more in 1910 with the same places in 1900. Comparing the two methods of classification, it appears that in Table V rural territory so called had a population of 1,544,717 in 1910 and 1,659,467 in 1900; but we find from Table VI that, when we consider the same rural territory

TABLE VI. COMPARATIVE POPULATIONS 1900-1910.

CLASS OF PLACES.	POPULATION		INCREASE 1900 TO 1910.	
	1910	1900	Number	Per cent
<i>The state</i>	2,224,771	2,231,853	*7,082	*0.3
Urban territory in 1910.....	680,054	567,267	112,787	19.6
Places of 25,000 or more in 1910.	330,091	253,537	76,554	30.2
Places of 2,500 to 25,000 in 1910	349,963	313,730	36,233	11.5
Remainder of the state.....	1,544,717	1,664,586	*119,869	*7.2

*Decrease.

in 1900 as in 1910, it shows a population of 1,664,586. In the one case, we are comparing the same group in the two periods, while in the other case a study is made of the increase or decrease of population within a certain class as determined by the census of 1910. By this method of classification it appears that urban territory based upon the census of 1910 increased in population 112,787 or 10.6 per cent while rural territory decreased in population 119,869 or 7.2 per cent. The difference between the two, 7,082 or three-tenths of one per cent represents the decline in population of the state at large.

In conclusion it will be noted that the decline of rural population as defined by the Federal Census is 119,869 in Table VI and 114,750 in Table V. The difference between the two methods of comparison is even more striking when we come to make an estimate of the rural population outside of incorporated places. Tables VII, VIII and IX follow the same method of comparison employed in Table VI. The purpose of these tables and of similar ones for smaller towns and cities not included in the bulletin is to form a more accurate estimate of the increase or decrease within certain groups or classes especially the increase or decrease of rural population outside of incorporated places. As already noted, the Federal Census has no separate classification for unincorporated towns and therefore it is not possible to determine the exact population of what is strictly speaking rural territory.

Table VII gives the population of cities of 10,000 or more for the Federal Censuses of 1900 and 1910, also for the State Census of 1905. The classification made in this table and

TABLE VII. CITIES OF 10,000 OR MORE IN 1910.

City	County	Population 1910	Population 1900	Increase or* Decrease 1910 over 1900	Population 1905	Increase or* Decrease 1905 over 1900
Boone.	Boone.	10,347	8,880	1,467	9,500	620
Burlington.	Des Moines.	24,324	23,201	1,123	25,318	2,117
Cedar Rapids.	Linn.	32,811	25,656	7,155	28,759	3,103
Clinton.	Clinton.	25,577	22,698	2,879	22,756	58
Council Bluffs.	Pottawattamie.	29,292	25,802	3,490	25,281	— 571
Davenport.	Scott.	43,028	35,254	7,774	39,797	4,343
Des Moines.	Polk.	85,368	62,139	24,229	75,626	13,487
Dubuque.	Dubuque.	38,494	36,297	2,197	41,941	5,644
Fort Dodge.	Webster.	15,543	12,162	3,381	14,369	2,207
Iowa City.	Johnson.	10,091	7,987	2,104	8,497	510
Keokuk.	Lee.	14,008	14,641	— 633	14,604	— 37
Marshalltown.	Marshall.	13,374	11,544	1,830	12,045	501
Mason City.	Cerro Gordo.	11,230	6,746	4,484	8,357	1,611
Muscatine.	Muscatine.	16,178	14,073	2,105	15,087	1,014
Ottumwa.	Wapello.	22,012	18,197	3,815	20,181	1,984
Sioux City.	Woodbury.	47,828	33,111	14,717	40,952	7,841
Waterloo.	Black Hawk.	26,693	12,580	14,113	18,070	5,490
Total		467,198	370,968	96,230	421,090	50,122

*Minus sign (—) denotes decrease

the one following is based upon the population for 1910. It appears that the seventeen cities belonging to this class had a population of 467,198 in 1910 and 370,968 in 1900, making a total increase of 96,230 for the decade. The same group of cities had a population of 421,090 in 1905 or an increase of 50,122 for the first half of the decade. It will be noted that Keokuk is the only city which declined in population between 1900 and 1910 while Keokuk and Council Bluffs both declined in population for the first five years of the period.

TABLE VIII. CITIES OF 2,500 TO 10,000 IN 1910.

City	County	Population 1910	Population 1900	Increase or Decrease 1910 over 1900	Population 1905	Decrease 1905 over 1900
Total.....		212,856	195,604	17,252	208,402	12,798
Albia.....	Monroe.....	4,969	2,889	2,080	3,957	1,068
Alcona.....	Kossuth.....	2,908	2,911	—3	3,047	136
Ames.....	Story.....	4,223	2,422	1,801	3,292	870
Anamosa.....	Jones.....	2,983	2,891	92	2,878	—13
Atlantic.....	Cass.....	4,560	5,046	—486	5,180	134
Belle Plaine.....	Benton.....	3,121	3,283	—162	3,322	39
Carroll.....	Carroll.....	3,546	2,882	664	3,203	321
Cedar Falls.....	Black Hawk.....	5,012	5,319	—307	5,329	10
Centerville.....	Appanoose.....	6,936	5,256	1,680	5,967	711
Chariton.....	Lucas.....	3,794	3,989	—195	4,045	56
Charles City.....	Floyd.....	5,892	4,227	1,665	4,546	319
Cherokee.....	Cherokee.....	4,884	3,865	1,019	3,998	133
Clarinda.....	Page.....	3,832	3,276	556	4,020	744
Colfax.....	Jasper.....	2,524	2,053	471	2,553	500
Cresco.....	Howard.....	2,658	2,806	—148	2,931	125
Creston.....	Union.....	6,924	7,752	—828	8,382	630
Decorah.....	Winnebiek.....	3,592	3,246	346	3,918	672
Denison.....	Crawford.....	3,133	2,771	362	3,173	402
Eagle Grove.....	Wright.....	3,387	3,557	—170	3,122	—435
Estherville.....	Emmet.....	3,404	3,237	167	3,650	413
Fairfield.....	Jefferson.....	4,970	4,689	281	5,009	320
Fort Madison.....	Lee.....	8,900	9,278	—378	8,767	—511
Glenwood.....	Mills.....	4,052	3,040	1,012	2,505	—535
Grinnell.....	Poweshiek.....	5,036	3,860	1,176	4,634	774
Harlan.....	Shelby.....	2,570	2,422	148	2,645	223
Hampton.....	Franklin.....	2,617	2,727	—110	2,800	73
Independence.....	Buchanan.....	3,517	3,656	—139	3,838	182
Indianola.....	Warren.....	3,283	3,261	22	3,396	135
Iowa Falls.....	Hardin.....	2,797	2,840	—43	3,049	209
Knoxville.....	Marion.....	3,190	3,131	59	3,194	63
Le Mars.....	Plymouth.....	4,157	4,146	11	5,041	895
Manchester.....	Delaware.....	2,758	2,887	—129	2,978	91
Maquoketa.....	Jackson.....	3,570	3,777	—207	3,666	—111
Marion.....	Linn.....	4,400	4,102	298	4,112	10
Missouri Valley.....	Harrison.....	3,187	4,010	—823	3,330	—680
Mount Pleasant.....	Henry.....	3,874	4,109	—235	3,576	—533
Mystic.....	Chickasaw.....	2,663	1,758	905	2,056	298
Newton.....	Jasper.....	4,616	3,682	934	4,398	716
Oelwein.....	Fayette.....	6,028	5,142	886	5,632	490
Oskaloosa.....	Mahaska.....	9,466	9,212	254	10,203	991
Pella.....	Marion.....	3,021	2,623	398	2,946	323
Perry.....	Dallas.....	4,630	3,986	644	4,173	187
Red Oak.....	Montgomery.....	4,830	4,355	475	4,907	552
Sheldon.....	O'Brien.....	2,941	2,282	659	2,564	282
Shenandoah.....	Page.....	4,976	3,573	1,403	4,242	669
Spencer.....	Clay.....	3,005	3,095	—90	3,137	42
Valley Junction.....	Polk.....	2,573	1,700	873	2,009	309
Vinton.....	Benton.....	3,336	3,499	—163	3,487	—12
Washington.....	Washington.....	4,380	4,255	125	4,489	234
Waverly.....	Bremer.....	3,205	3,177	28	3,353	176
Webster City.....	Hamilton.....	5,208	4,613	595	4,797	184
Winterset.....	Madison.....	2,818	3,039	—221	2,956	—83

*Minus sign (—) denotes decrease.

Table VIII gives the population of cities of 2,500 to 10,000 for the Federal Censuses of 1900 and 1910, also for the State Census of 1905. The fifty-two cities belonging to this class in 1910 show a population of 212,856 as compared with a population of 195,604 in 1900 or an increase of 17,252 for the decade. The same group of cities had a population of 208,402 in 1905, an increase of 12,798 indicating that the major part of the increase took place during the first half of the ten-year period. It also appears that of the fifty-two cities in the class under consideration, nineteen decreased in population between 1900 and 1910 and only eight decreased in population during the first half of the same period.

The writer has prepared three additional tables which are too long to be included in the bulletin. These tables contain the same data, first for towns and cities of 1,000 to 2,500 inhabitants, second, towns of 500 to 1,000 and third, incorporated places less than 500, the classification being based upon the population for 1910. In making a study of the increase or decrease of population in said groups of towns and cities, it was necessary to eliminate those towns and cities which were not incorporated in 1900 in order to follow out the method of comparison adopted in tables VI, VII and VIII.

By thus eliminating the 156 towns and cities not incorporated in 1900 and which had a total population of 36,330 in 1910, we are able to determine whether or not towns and cities within a certain class have actually increased or decreased in population during the last ten years. A comparison of this kind reveals the fact that towns and cities of 1,000 to 2,500 show an actual decline in population of 1,830 during the last decade. Towns of 500 to 1,000 which were incorporated prior to 1900 show a small increase of 667 in population while towns of less than 500 which were incorporated prior to 1900 have decreased in population 2,234 during the same period. There is no way of determining from the census how much the 156 towns and cities not incorporated in 1900 increased or decreased in population because they belonged in a different group in 1900 than in 1910, and as already explained the census does not differentiate between unincorporated places and strictly rural population.

Summing up the results of our study within certain classes or groups we find that the urban population as defined by the Federal Census increased 113,482 or approximately 20 per cent during the last decade which as the reader will observe varies a little from the amount and percentage given in Table VI. Towns and cities of less than 2,500 declined in population 3,397 which means that the total population of all cities and

incorporated places increased 110,085 during the last decade. When we consider that the state at large decreased 7,082 it appears that the rural territory including the 156 towns in-

TABLE IX.

TOWNS NOT INCORPORATED IN 1900

Town	1910 Population	Town	1910 Population	Town	1910 Population
Albert City.....	261	Hinton.....	329	Ryan.....	511
Alexander.....	262				
Andover.....	51	Huxley.....	336	Sergeant Bluff.....	525
Ankeny.....	445	Jamaica.....	379	St. Lucas.....	138
Archer.....	351	Kanawha.....	398	Sandyville.....	120
Arispe.....	155	Kent.....	158	Scarville.....	129
Atalissa.....	220	Kimballton.....	271	Shambaugh.....	215
Bailey.....	226	Knierim.....	220	Sharpsburg.....	181
Bettendorf.....	909	Lanesboro.....	268	Soldier.....	167
Blairsburg.....	241	Latimer.....	378	Somers.....	169
Blakesbury.....	344	Laurel.....	179	Spring Hill.....	94
Blue Grass.....	223	Lawton.....	138	Stockport.....	265
Brandon.....	200	Le Roy.....	185	Stockton.....	138
Bridgewater.....	365	Lidderdale.....	114	Sully.....	282
Buck Grove.....	87	Littleport.....	166	Tiffin.....	176
Buckeye.....	140	Lost Nation.....	523	Toronto.....	106
Carbon.....	246	Lovilia.....	552	Treynor.....	122
Carpenter.....	121	Luther.....	130	Truro.....	310
Castalia.....	230	McCallsburg.....	309	Turin.....	154
Charlotte.....	356	McCausland.....	106	Udell.....	186
Chatsworth.....	131	McClelland.....	134	Underwood.....	271
Chester.....	266	Magnolia.....	311	Varina.....	183
Clayton.....	145	Maloy.....	127	Webb.....	150
Cleghorn.....	186	Masonville.....	282	Webster.....	127
Clemons.....	213	Maysville.....	55	Weldon.....	303
Clutier.....	186	Melvin.....	195	Welton.....	61
Conesville.....	347	Meyer.....	387	Westfield.....	143
Coppock.....	105	Mingo.....	246	Woden.....	162
Coulter.....	198	Moneta.....	44	Yale.....	273
Curlew.....	161	Moorland.....	137	Yetter.....	107
Dana.....	183	Mt. Auburn.....	228	Zwingle.....	69
Daneville.....	263	Mt. Sterling.....	232		
Dawson.....	275	Mt. Union.....	195		
Delhi.....	375	New Liberty.....	93		
DeLoit.....	208	New Virginia.....	396	Total.....	36,330
Derby.....	326	Nodaway.....	323		
Dickens.....	255	North Buena Vista..	162		
Dike.....	286	North Washington ..	132		
Dixon.....	198	Northboro.....	197		
Dolliver.....	107	Numa.....	659		
Donahue.....	64	Oakville.....	389		
Dougherty.....	171	Olds.....	165		
Elkhart.....	132	Osterdock.....	97		
Ely.....	161	Ottosen.....	147		
Everly.....	392	Oyens.....	94		
Exeline.....	660	Palmer.....	177		
Fenton.....	211	Palo.....	208		
Ferguson.....	127	Pioneer.....	92		
Fertile.....	207	Pisgah.....	212		
Frazer.....	537	Plymouth.....	358		
Garber.....	131	Popejoy.....	200		
Garnavillo.....	342	Prairieburg.....	187		
Geneva.....	199	Promise City.....	274		
Gilbert.....	235	Quasqueton.....	394		
Goose Lake.....	110	Quimby.....	268		
Grandview.....	374	Rake.....	163		
Granger.....	225	Ralston.....	175		
Green Island.....	128	Readlyn.....	227		
Guernsey.....	143	Rembrandt.....	128		
Halbur.....	147	Ricketts.....	102		
Hanlontown.....	129	Ringsted.....	313		
Harper's Ferry..	297	Rowan.....	256		
Harvey.....	346	Runnels.....	428		
Hills.....	195	Rutland.....	212		

incorporated in 1910, but which constituted strictly rural territory in 1900 must have decreased 117,167.

Table IX gives the 156 towns with a total population of 36,330 in 1910 which were included as strictly rural territory in 1900. While we cannot determine whether these towns increased or decreased in population it is reasonable to assume by a comparison with incorporated places of less than 500, also from 500 to 1,000 that the increase, if any, must have been small. In other words, it may be safely alleged that the decline in rural population outside of unincorporated places could not have been less than 100,000 and has probably been at least 115,000 or even more during the decade under consideration. This, however, is a very different amount than the 152,673 given in table V, which as already explained results from the arbitrary transfer of the towns given in Table IX from one group in 1900 to a different group or class in 1910. It is certainly a remarkable and striking fact that the population of the rural districts has declined at least ten per cent since 1900.

Table X is a comparative study of twelve states showing the number of counties that have increased or decreased in population during the last two decades. A glance at this

TABLE X. COMPARATIVE STUDY.

STATE	No. Counties	Increase of Population		Decrease of Population	
		1900 Over 1890	1910 over 1900	1900 over 1890	1910 over 1900
Illinois.....	102	96	50	6	52
Indiana.....	92	78	36	14	56
Iowa.....	99	98	28	1	71
Kansas.....	105	51	72	54	33
Michigan.....	83	63	57	20	26
Minnesota.....	86	80	53		29
Missouri.....	115	95	44	20	71
New York.....	61	38	46	22	15
Ohio.....	88	66	49	22	39
Pennsylvania.....	52	38	36	14	16
Virginia.....	100	66	67	34	53
Wisconsin.....	71	67	50	1	20

table shows that the recent decline in population of a large group of counties is not peculiar to Iowa. In fact this decline has been quite general in a group of states in this section of the Union and has also taken place in eastern states especially in earlier decades.

Between 1890 and 1900, fifty-four counties out of 105 in Kansas decreased in population; fourteen in Indiana; twenty-two in New York and a similar number in Ohio; thirty-four in Virginia; twenty in Missouri, a like number in Michigan and only one in Iowa. In other words, while Iowa did not show

a tendency to decline in population from 1890 to 1900, a considerable group of states did manifest such a tendency which indicated in these states a substantial decrease of rural population.) While seventy-one counties of Iowa declined in population during the decade ending 1910, it will be observed that exactly the same number of counties also declined in population in Missouri, fifty-six in Indiana, fifty-two in Illinois, thirty-nine in Ohio, thirty-three in Virginia and a like number in Kansas, twenty-nine in Minnesota and twenty in Wisconsin. It is thus apparent that the decline in rural population has been general in certain sections of the Union and is therefore due, in the main, to conditions not peculiar to Iowa. Causes of this decline in rural population properly belong in the field of agricultural economics and will not be discussed in this bulletin which is a study of population as related to the industries. Much interest is now being manifested in rural or agricultural economics, so called, and no doubt the small group of able economists interested in this subject will publish from time to time the results of their investigations.

Concluding our statistical study of Iowa population, it may be stated, as already observed, that the Federal Census of 1880 represents an important turning point in the history of Iowa. After making a comparative study of the various tables presented in this chapter it is evident that the increase in population was due primarily, in fact, almost entirely, to the development of the rural districts prior to 1880, but since that time the increase, where such has occurred, is explained very largely by the growth of towns and cities, especially the larger cities. While it is not possible to make an absolutely accurate comparison of the rural population for the census of 1880 with those following, on account of the different basis of classification, it may be safely alleged that, after making all reasonable allowance, the population in the rural districts in 1880 was approximately the same and may have been even greater than it is at the present time.

It will be recalled that Table V shows a rural population outside of all incorporated places of 1,210,035 in 1890, 1,258,675 in 1900 and 1,106,002 in 1910 representing a small increase during the former decade followed by a great decrease during the latter. In 1880, the total population of Iowa was 1,624,615 and the urban population so defined as to include cities of 4,000 and over, 201,800, leaving a so-called rural population of 1,422,815, which, however, included all cities and incorporated places of less than 4,000. The question is what was the population of said incorporated places less than 4,000? This can-

not be accurately determined, but, assuming that it was as great in 1880 as in 1890 or 372,099, we have a rural population outside of all incorporated places of 1,050,716. When we consider, however, the large increase from 385,364 in 1890 to 555,205 in 1900, in the population of towns and cities of 5,000 and less it is reasonable to assume that there must have been a substantial increase in this same class of towns between 1880 and 1890. Assuming, however, that the increase in towns of this class between 1880 and 1890 was half as large as during the following decade or 84,970, which is a conservative assumption when we consider that the general increase in population was much greater during the former than during the latter decade, it is evident that the above estimate of 1,050,716 for rural population in 1880 must be increased to 1,135,686 or more than the rural population indicated by the Federal Census of 1910.

Two vital facts therefore stand out in a statistical study of Iowa population: First, that the rural population has not increased during the last thirty years; and second, that during the last decade the increase of population in cities of 2,500 and over has not been great enough to more than counteract the substantial decline in rural population. In a number of other states a similar decline in rural population has been counteracted by the growth of cities as a result of encouragement given to manufacturing and commerce. It is the business of agricultural or rural economists to explain first, why the total rural population has remained stationary since 1880, and second, why the average Iowa county has lost at least 1,000 people in the rural districts since 1900. On the other hand it is the duty of the engineering economist and of the so-called engineering sciences to explain how it is possible to develop the manufacturing, commercial and mining industries of the state in order to build up the cities, thus increasing the population and enhancing the wealth both of the cities and of the rural districts. In other words, if we desire Iowa to increase in population, we must encourage a policy which will make it a great industrial as well as a great agricultural commonwealth.

CHAPTER II.

CAUSES AND REMEDIES OF A DECLINING POPULATION.

In the preceding chapter the writer endeavored to present a statistical survey of Iowa population both from an historical and comparative standpoint and at the same time contrast the

growth of urban as distinguished from rural population. Two important facts were established by said investigation; first, that the rural population has remained stationary since 1880, considering the period as a whole, and has declined on an average of at least 1,000 for each county during the last ten years; second, that the total increase in Iowa population from 1880 to the present time has been due almost entirely to the growth of towns and cities and the small decline during the last decade is explained by the fact that towns and cities have not developed rapidly enough to more than counteract the decline in rural population so general throughout the Middle West.

It is therefore obvious that the problem of population in Iowa involves a dual investigation; first, of the causes and remedies for the decline in the rural districts and second, the reasons why our towns and cities have failed to grow as rapidly as in the leading industrial states, thus counteracting the effect of the rural decrease.

The purpose of this bulletin is to make the latter investigation, leaving to the agricultural economist the equally important task of explaining the former. As already intimated a small group of enthusiastic and capable economists are developing the subject of the economics of agriculture. No doubt they will be able at some future time to give a satisfactory explanation of the problem of rural population. Personally the writer is of the opinion that we have, in the country life movement, the rural church, rural school and a group of closely allied institutions a fruitful field for careful investigation. Something has already been accomplished. At the present time economists, like Professor Carver, of Harvard, Professor Taylor, of the University of Wisconsin, and Professor Hibbard, of Ames, are engaged in thoroughly scientific work in this field, which work promises to bring forth substantial results.

If the experience of the last thirty years means anything, however, it would tend to indicate that, under existing conditions, here in Iowa, the problem of an increasing population is not primarily one of agriculture. When we consider that our increase in population since 1880 must be explained either by the coal mining industry or the commercial and manufacturing activity of towns and cities one is inclined to accept, with a grain of salt, the assurance that "back to the farm," is the true method of realizing a Greater Iowa both in population and wealth. The writer is inclined to agree with Prof. J. B. Davidson, head of our Department of Agricultural Engineering, when he suggests that the continued improvement

in farm machinery will tend to increase rather than decrease the size of farms. There is also some reason to believe that, with the building of permanent roads and improving in general the methods of transportation, there may be a tendency for the social, educational and religious centers to coincide with the centers of economic activity, which, in the majority of cases, will mean the towns, villages and cities. In a word, the rural church and rural school may become the town or village church and the town or village school. If such a unified system would result in greater efficiency there is no reason why it should not prevail.

If it is true that the small decline in the total population of Iowa during the last ten years is due to the fact that manufacturing and commerce have not developed rapidly enough in the cities to more than counteract the substantial decrease of population in the rural districts; it is evident that the causes which have retarded the industrial development of the state are worthy of careful study. In investigating this important question, letters have been received from about 175 of the leading manufacturers of Iowa, also from a number of commercial clubs.

Among the causes which have retarded the growth of industrialism the following are mentioned most frequently by manufacturers and commercial clubs: Discriminatory freight rates; failure of individuals and especially banks to invest their money in factories; adverse legislation; the lack of an industrial population, and of an efficient system of industrial schools; failure of our own people to buy Iowa made goods; high taxation on moneys and credits and a bad system of taxation in general; the suggestion that Iowa is an agricultural, not a manufacturing state; lack of raw materials; need of more advertising, and the necessity of cheap water power. Other causes are suggested, such as strikes, too much politics and agitation and the fact that we do not have a large amount of cheap labor. One writer complains of anti-liquor legislation, and another suggests that Sears, Roebuck and Montgomery Ward & Co. are primarily responsible for the decline in population.

Of the causes which prevent the legitimate growth of Iowa factories, discriminatory freight rates are most frequently mentioned. More than one-third of the letters received from every section of the state refer directly to this condition, and a number of other letters suggest the same thought. Adverse legislation and the great need of industrial training are about equal in importance. One-fifth of the letters emphasize the absence of a proper system of industrial education and also speak in very positive terms concerning the disposition of our

General Assembly to discriminate against the Iowa factory; in other words, to enact agriculture made laws. About one-fifth of the letters refer to the failure of capitalists to make investments in legitimate manufacturing enterprises. It is alleged that banks will loan freely on real estate security and on ordinary personal property, but will not loan to the factories.

In order to present more completely the views of Iowa manufacturers and commercial clubs regarding the causes which are retarding our industrial growth as a state, it is well to consider what are in reality the fundamentals of an industrial society. By making these fundamentals the basis of our classification and study, we will be able to reduce the apparently conflicting views of practical as well as scientific men to a reasonably logical system of thought.

Any state or nation to achieve leadership along industrial lines must possess the following: An industrial population, which demands a comprehensive system of secondary industrial schools together with higher institutions of learning along technological or applied science lines; material resources or, in other words, raw materials to be worked up in factories; an efficient transportation system with just and reasonable rates, which make a wide market possible; an abundance of cheap power, and finally a large amount of capital for investment in manufacturing and commercial enterprises. These considerations will be discussed briefly in their direct order.

Among the fundamentals of industrialism—people, natural resources, transportation or markets, power and capital—it will be generally admitted that the first is from certain stand-points the most essential. A state or nation may have practically unlimited resources and yet not achieve leadership along industrial lines simply because of the absence of an industrial population. It was an industrial population in the sixteenth and seventeenth centuries, which gave Holland and later England, their commercial supremacy. It was the lack of an industrial population in Spain, which caused her national wealth to decline, in spite of vast colonial resources in America. At the present time, Germany is strong and has won a recognized commercial leadership primarily because of her industrial and technological schools while Japan following a similar policy during the last half century has become one of the great commercial and military powers. On the other hand, China, with practically unlimited natural resources, is still primarily an agricultural community and is just beginning to learn the lesson of modern industrialism and with it of modern democracy as well.

Up to the present time, we, in Iowa, have given practically no attention to the important question of industrial education. During the last few years considerable interest has been manifested in the subject of agricultural education, which is now required to be taught in all of our public schools. Recognizing the great importance of this line of work, the State Board of Education has recently established at Iowa State College a regular Department of Agricultural Education. While this is an important departure from the old-time methods of public school work, yet such a Department has an important field of usefulness, and by cooperation with Agricultural Extension and the other regular Departments of the Agricultural Division on the one hand, and the public schools on the other, it will be able to render an invaluable service to the people of Iowa. Every progressive citizen desires to see agricultural education placed on a more substantial basis and be made a permanent and important part of our secondary school system.

It is to be regretted, however, that the same interest has not been taken in the equally important subject of industrial education. Our public schools at the present time are very defective and are pursuing wasteful and unscientific methods of instruction. In no other respect, however, is the system quite so defective as along the line of training in the industrial and mechanic arts. Outside of our leading cities very little has thus far been accomplished or even suggested.

A leading manufacturer in Council Bluffs, speaking of the things which will promote industrial development, thus writes: "About the first, perhaps the very first and most important, will be trade and industrial schools, whereby the young man may get some knowledge of manufacturing. Skilled labor or labor of any kind except farm labor does not seek our state for employment and it is therefore doubly essential to provide some adequate means of training our own people along industrial lines."

A manufacturer in Des Moines has the following to say: "Iowa needs manufacturers more than she needs manufacturing, that is, if Iowa had manufacturers, manufacturing would come as a natural sequence. You find eastern cities where one city will manufacture one-half or three-fourths of a certain kind of product that is used all over the United States." In a large number of letters the suggestion is made that, "The people have not been educated to the fact that Iowa can manufacture successfully." The writer might add quotations along this line almost indefinitely.

Concerning the research and experimental side of industrial education, a manufacturer in Burlington writes: "I

think your Engineering Department could now well look into the electric power situation as we expect a very large development of electric power at Keokuk, Iowa, that will be distributed all over the southeastern part of our state." Mr. R. H. Burton Smith, of the Sioux City Foundry and Manufacturing Company, makes the following suggestion: "It would be a fine idea if we could send samples of cast iron to you to be analyzed chemically in order to discover proper mixtures for the several sorts of castings that we may turn out." A manufacturer in Davenport thus refers to the field of research in Engineering Economics: "My experience has been that the average manufacturer cannot tell the exact cost of the different elements which enter into the finished product and they only arrive at the results of their operations by waiting until some dull period in order that they may take stock and cast up their results and then when they finally do arrive at the result they cannot say just where the profits or losses were." Numerous other letters might be quoted which deal especially with the field of experiment and research.

It is apparent from reading these statements and making even a superficial study of our economic system, that an industrial population, which means industrial education in the secondary schools and research and experimental work in the higher institutions of applied science, is one of the greatest needs of Iowa at the present time. Said industrial education, considered in the large, must necessarily comprehend the following: first, a group of experimentalists and research workers in the various fields of the engineering sciences, in other words, an Engineering Experiment Station, amply equipped and supported to serve the diversified needs of the Iowa manufacturer; second, a technological institution of higher instruction, such as the Engineering Division of the Iowa State College, whose function is to turn out efficient, practical engineers, trained experimentalists, and possibly at the same time provide a corps of instructors for secondary industrial schools; and third, a secondary school system operated so as to afford a substantial training in the industrial and mechanic arts. The first two parts of this program of industrial education properly belong in the field of higher instruction. In other words, a regular high-grade college with a well equipped Experiment Station is in a position to provide experimentalists, research workers, trained practical engineers and instructors competent to assume a leadership in the general field of industrial education.

When we come, however, to the trained artisan or skilled

worker, as that term is generally understood, we are in the legitimate field of secondary instruction in the mechanic arts. Instruction of this kind must necessarily be given in the various cities and other local communities of the state. Such a system of secondary industrial education may be worked out in connection with our present public school system, or we may establish industrial high schools, night schools, continuation schools of one kind or another and, in some cases, independent technical schools. In planning a thorough and efficient system of secondary industrial education, it is not practicable to follow hard and fast lines. The personal equation is important and the particular needs of a certain city or locality are always fundamental. In other words, industrial education, following the valuable experience of Germany, should be modeled along the lines of the actual industrial life of each community.

Trade schools or secondary industrial schools therefore should be established in every section of the state, either on an independent basis, or in connection with the existing public school system; and where practicable night schools and continuation schools may be established. Such a system of schools is required to meet the needs of a great industrial state just as much as secondary instruction in agriculture is required to meet the needs of a great agricultural state. The College of Engineering, with its Experiment Station, can assume a leadership in secondary industrial education similar to the leadership now being exercised by the College of Agriculture and the Agricultural Experiment Station, in the field of agricultural education. In both cases the mass of skilled agriculturalists or trained artisans must necessarily receive their instruction close to home and in secondary schools.

In this connection, the writer has been much impressed with the great importance of College Extension Work. If a central institution of higher instruction is to assume a practical and efficient leadership of a secondary school system over a large territory it must be accomplished through the principle of Extension. In fact such a leadership has already become a reality in the field of agricultural education through the Extension Division of the College of Agriculture. Through an application of the same principles, the College of Engineering may likewise obtain a much needed leadership in the equally important field of secondary instruction in the industrial and mechanic arts.

Along this important line, the work of the Extension Division of the University of Wisconsin is significant. While an effort was being made in Iowa to secure \$100,000 for Agri-

cultural Extension, the Chamber of Commerce of Milwaukee was asking the Wisconsin Legislature to appropriate \$150,000 for Engineering Extension.

The following statement of Dean L. E. Reber, of the University of Wisconsin, will be instructive:

"To the unbiased observer, the policy which has led to the introduction in the university of extension methods for the agricultural interests only, would seem to be mistakenly limited. A large majority of the students entered in commercial schools are engaged in technical studies other than agricultural. Trade schools, technical institutes, apprenticeships, industrial courses in high schools and colleges—widespread as they are—are not sufficiently inclusive to meet the tremendous demands for utilitarian education. The need for increased intelligence and fitness in the American wage earner is acknowledged. Skilled labor must frequently be imported and, at best, only certain American products can compete with foreign. The state of Wisconsin is making an effort to meet this condition through the establishment of her University Extension Division for all classes and for every vocation as an organic part of her state educational system. As will be shown, by far the largest application of the work up to this time has been in the direction of vocational training."

Speaking of the actual work now being done by the Extension Division at Madison, Dean L. E. Reber thus writes:

"The work which has been inaugurated at Milwaukee in the West Allis schools suggests great possibilities for co-operation between extension and the schools throughout the state. The introduction of vocational training in all schools, whether in cities or villages, becomes possible, through the instrumentality of the university extension division, at a cost which any school board should be able to meet. Requests have come to the extension division for just such co-operation but, under the present conditions of district development, response has been found impossible on account of the isolation of those making application. Participation in class work in the public schools can be carried on only in towns and cities or where a number of schools in adjoining districts can co-operate to make a practicable itinerary for the teacher. The growing appreciation of the need for vocational training, and the possible prospect of definite legislation relating to it, presents to the extension division a large field of service."

It would require a monograph rather than a bulletin to present even the one subject of industrial education in a satisfactory manner, but enough has been suggested to indicate the great relative importance of the problem. An industrial state requires an industrial population and an industrial population is the logical product of a scientific school system. Such a system requires a group of secondary schools on the one hand and a higher institution of applied science on the other. The College of Engineering with its Experiment Station, will not be able to come in close contact with the industrial life of the state and at the same time assume the necessary leadership of secondary schools of the industrial and mechanic arts, except through an Extension Division of Engi-

neering, which will serve as a cementing principle of the whole educational organism. The experience of Wisconsin is conclusive along this line. Her Extension Division has made it possible for the University of Wisconsin to be of immediate practical service to the manufacturing and commercial life of that state. In other words, if we are to solve the problem of a declining population we must spend a dollar to help young men in the shops of our cities every time we spend a dollar to carry the message of scientific agriculture to the young man on the farm. Engineering Extension, in a word, is just as necessary as Agricultural Extension if we are to make Iowa a great industrial as well as a great agricultural state.

We come now to the question of natural resources, which necessarily can receive only a brief consideration. From letters received there appears to be a great diversity of opinion among Iowa manufacturers as to whether or not Iowa possesses adequate resources to become a leading industrial state. In fact, there seems to be a lack of definite scientific information along this line.

A manufacturer of Ottumwa thus writes: "Iowa is an agricultural state and not a manufacturing state. It possesses neither mineral nor timber. The coal is somewhat uncertain and of a quality that cannot be used in handling iron or making gas." A similar opinion is expressed by a firm in Cedar Rapids: "Iowa is an agricultural state and produces very few of the raw materials that enter into a general line of manufacturing; furthermore, the cost of fuel in most sections of Iowa is a considerable item."

Illustrating the optimistic view, however, a manufacturer in Des Moines says: "There is no reason why Iowa should not make the agricultural implements, wagons and vehicles she uses. There is no reason why Iowa should not make cotton and woolen goods. There is no reason why Iowa should not make the gloves, clothing and other materials that she uses. In fact, anything that can be made, in general at a profit, with the exception perhaps of some iron and steel articles can be made here, and at a profit." Between these extreme views, we might quote many different shades of opinion expressed by manufacturers in every section of the state.

It has been only too often assumed in a general way that Iowa is distinctly an agricultural state and therefore does not possess the resources to become a leading manufacturing state. This generalization is not new. It has been applied to other states and, in fact, a hundred years ago was quite generally applied to the nation at large. When Thomas Jef-

erson was president he said repeatedly that agriculture was the main stay of the nation, that it was the one resource on which we must depend as a people; and numerous other leaders of thought, at that time, expressed the same opinion. In a word there has always been a tendency to believe that simply because a community or state or nation happens to possess great agricultural resources, it cannot possess at the same time the other resources, required to lay the foundation of an industrial society. England, centuries ago, passed through this stage of conservative generalization; and prior to the War of 1812, our eastern states had a similar experience. In the same way Iowa is now looked upon as an agricultural and not an industrial commonwealth.

It is true that Iowa does not possess the precious metals. We have no gold, silver or copper and only a small amount of iron, zinc and lead. On the other hand, we have an almost unlimited amount of coal, extensive gypsum deposits in the vicinity of Ft. Dodge and Centerville and practically an inexhaustible supply of rock, clay and sand for the manufacture of brick, tile, cement and similar products.

It will be generally admitted that, under existing conditions, Iowa is not likely to become a great smelting state. We do not have a large quantity of iron ore nor do we have the advantage of cheap water transportation, which is required to obtain the same from other localities. Indiana, Ohio and Pennsylvania take a high rank in the manufacture of iron and steel products simply because they possess large quantities of cokable coal and at the same time are able to obtain iron ore and other necessary metals by means of water transportation on the Great Lakes. Many well-informed people have observed these conditions and have assumed that Iowa cannot become a leading industrial state without taking the time to make a careful investigation of facts.

Even in the smelting business, the states of the Upper Mississippi Valley have decided natural advantages when we consider the possibilities of improved navigation on the Mississippi and its tributaries to the north, which reach the very heart of the iron mining section. In other words, the improvement of our inland waterways according to tentative plans, already outlined by a number of political and industrial leaders, will make it possible for cities along the Missouri and Mississippi rivers and perhaps even our interior waterways to obtain an abundance of iron ore and cokable coal by means of cheap water transportation. Add to this the fact that some Iowa coal has already been used for smelting purposes and that through scientific research and experiment, the

extensive coal fields of our state may be made vastly more useful along these lines, there is at least some reason to feel that Iowa in the future may manufacture a large amount of iron and steel products.

The writer has conferred a number of times, concerning our natural resources, with Mr. G. A. Wrightman, Secretary of the Iowa State Manufacturers' Association, and has been much interested in looking over the long list of Iowa manufacturing concerns. According to the latest bulletins of the Census Bureau and the records and observations of the Iowa State Manufacturers' Association, there are at present about 6,000 factories or establishments in Iowa, conducted under the factory system, having an annual output of at least \$500. The capital invested in these factories is estimated at \$225,000,000; cost of material used, \$220,000,000; salaries and wages, \$55,000,000; value of product, \$335,000,000; and number of wage earners, 72,000. It is therefore apparent that Iowa has already laid the foundations of an extensive industrialism.

The following are some of the most important commodities now being manufactured in Iowa on a very profitable basis: packing house products, dairy products, flour and feed, printing, railroad equipment, lumber, planing mill products, agricultural implements, cereals, starch, preserves and canned goods, gasoline engines, washing machines, clay products, vehicles, shoes, foundry products, automobiles and motor implements, proprietary medicines, hosiery, confectionery, garments, paint, brooms, pearl buttons, baskets, jewelry, furniture and cement. The city of Burlington, for example, is manufacturing the following articles: Furniture, lumber, soap, baskets, confectionery, wagons, chemicals, pipe organs, steam engines, desks, pearl buttons, canned goods and preserves, printing and binding, blank books, cigars, hardware specialties, carriages, monuments, packing house products, packing boxes, brick, horse shoes, sleigh bells, rugs, ice, tents and awnings, willow ware, mattresses, planing mill products, burial cases, carbonated beverages, gasoline engines, flour and mill stuffs, kitchen cabinets, bakery goods, garments, ice cream, harness and saddlery, fountain pens, agricultural implements, electrical supplies, steam boilers, extracts, perfumes, brooms, cabinets, water motors, paper boxes, chewing gum, lightning rods, and barrels.

A number of Iowa cities could show an even more extensive list of manufactured articles. While it is difficult to draw the line on just what constitutes a manufacturing plant the following is a conservative estimate made on the

basis of the Federal Census report of 1904, of the number of factories in our leading cities: Burlington, 175; Cedar Rapids, 175; Clinton, 100; Council Bluffs, 80; Davenport, 250; Des Moines, 350; Dubuque, 200; Ft. Dodge, 60; Ft. Madison, 50; Keokuk, 125; Marshalltown, 100; Mason City, 75; Muscatine, 75; Oskaloosa, 60; Ottumwa, 100; Sioux City, 125, and Waterloo, 200.

When it is possible for one city to have a successful iron works, packing company, pipe and tile company, cement plant and a long additional list of successful factories, it is difficult for the writer to understand why anyone should assume that Iowa cannot become a great industrial state. In view of the fact that clay and cement products are being employed in hundreds of forms as a substitute for wood, iron and steel, the brick, tile and cement industry alone has almost unlimited possibilities. It may safely be assumed that the clay and cement products of Iowa will be equally as important if not more so, from a manufacturing standpoint than the iron ore possessed by other states. When we consider also that the products of the farm must in the main either directly or indirectly undergo some manufacturing process before they are ready for final consumption, it is evident that the farms of Iowa are annually supplying millions of dollars worth of raw material for use in factories. Again the large amount of machinery required on the Iowa farm can easily be produced in the Iowa factory while in reality only a small per cent is now being so produced. The manufacture of farm machinery alone might contribute in a large measure to make Iowa a leading industrial commonwealth.

The series of articles now being published in Iowa factories giving a detailed account of leading manufacturing plants, will doubtless do much to convince the public that Iowa, from the standpoint of natural resources, at least, has a great industrial future. There are a number of forces which have retarded and are still retarding the growth of commerce and manufacturing in this state but the lack of sufficient natural resources does not belong in the list. Iowa has the natural resources along a large number of lines, and, with an industrial population, proper banking and credit facilities, just and equitable freight rates and a reasonable amount of state patriotism, can take a leading rank in the field of industrialism.

The third fundamental of any industrial society especially under existing conditions is transportation. Without transportation at low cost both on land and water, modern capitalistic industry with its billion-dollar corporation and world market would be impossible. The evolution of economic

society has been characterized by the gradual extension of the market, which, in turn, has been the result of improved methods of transportation. The present industrial order requires efficient transportation; first, to assemble raw material at the place where it is to be manufactured; and second, to distribute the finished product for the purpose of consumption. In other words, transportation is the keystone of the present industrial arch. This being the case the cost of transportation, or in other words, the system of freight rates is vital to the progress of any city or community.

The railroad has long been considered as a public service corporation, which means that the service rendered is of a public nature although the ownership and operation may be in private hands. This being true, the right of the state to regulate and control intrastate rates and the right of Congress through the Interstate Commerce Commission to regulate and control interstate rates, has become well established. The actual regulation, however, both by the nation and the several states is still very imperfect and, in fact, boards of railroad commissioners have been groping in the dark to discover methods of securing a just and equitable rate system. More, however, has been accomplished along this line during the last ten years than during the whole previous history of railroad transportation.

In writing even a brief and fragmentary statement regarding the important question of rates, it is necessary to make a careful distinction between the earnings or profits of a railroad on the one hand and the adjustment of specific rates as between individual shippers, cities, or larger territorial areas on the other. A railroad may be earning nothing more than reasonable profits and yet its rate system may be so adjusted as to favor one community and injure another. The writer has long been convinced that there has been, at least in some measure, a deliberate effort on the part of railroad managers to do this in order to be able to haul raw material a long distance to the factory and the finished product a long distance to the place of consumption. To be specific many railroad directors have imagined that it was to their interest to transport hides from the Iowa farm to the Massachusetts shoe factory in order to be able to transport shoes from the Massachusetts factory back to the Iowa farm.

Turning to the question of discrimination, it is important to bear in mind the different methods of classifying rates. For example, we have the percentage, basing point, zone or belt and blanket systems of rate making. The percentage system is used north of the Potomac and Ohio rivers and

east of the Mississippi. The rate from Chicago to New York is 100 per cent and other rates are fixed at a certain percentage of this amount. The rates in the southern states are classified in a large measure around Atlanta, New Orleans and other cities as basing points. In other sections and in dealing with certain special commodities the zone or belt system of making rates is adopted. Finally, all points in the territory east of the Missouri are given the same through rate to the Pacific Coast. In other words, this territory constitutes one large "blanket" for west bound rates, to the Pacific Coast, which explains the reason why a manufacturer in Des Moines is obliged to pay the same rate as is paid from Pittsburgh, for shipping structural steel to Los Angeles.

In addition to the main system of rate making, there are numerous and important modifications, which taken together constitute a very complex rate structure. Considering for a moment the rates now in force in Western Classification Territory, we must bear in mind; first, that Iowa is located between the Missouri and Mississippi rivers; second, that the state as a whole, is in the western edge of the large "blanket" already referred to which is given the same west bound through rates to Pacific Coast points; third, that railroad rates in the past have been made with special reference to Chicago, St. Paul, Minneapolis and St. Louis; and finally, that rates in general have been so adjusted as to discriminate against the Iowa manufacturer and in favor of eastern cities. The complicated rate structure which has been built up in this section of the Union as a logical result of competition, historical forces, proximity to the Missouri and Mississippi rivers and certain large distributing centers, the fact that transcontinental lines have been obliged in the past to rely very largely on through business, and numerous other factors, has placed the Iowa manufacturer between a number of mill stones and thus retarded very materially our industrial development.

The actual situation is stated by Johnson and Huebner, *Railroad Traffic and Rates* (Volume I, p. 441) in the following terms: "West of Lake Michigan and of the Mississippi River, south of the Wisconsin-Illinois boundary, a third general system of railway charges has developed, the salient characteristic of which is a general adjustment of rates by fixed differentials above or below the rates at the dominating trade centers and main river crossings. This general adjustment of rates by fixed differentials is supplemented to some extent by making the charges at certain secondary competing points percentages of the rates at a primary center

of industry and trade. Moreover, the practice prevails of extending the rates at a large city where competition is active throughout the district of which it is the center."

In addition to the methods of rate making already outlined, the reader should bear in mind that largely for the sake of convenience freight must be grouped into a number of different classes. At present there are about twelve distinct methods of classifying freight in the United States. In the Western Classification Territory, which includes Iowa, there are ten main classes—five numbered and five lettered—and a large number of commodities are rated at one and one-half, two, two and one-half, three, three and one-half, or four times first class. In other words, there are practically sixteen distinct classes aggregating thousands of items. When we consider that for heavy and bulky freight, separate commodity rates are granted, the reader will form some impression of the complicated nature of the rate system.

The Interstate Commerce Commission has ruled that classification of freight, "Must be based upon a real distinction from a transportation standpoint." Among other factors, which should be considered in any classification of freight are the value of the article, cost of service, risk as in the case of glass or other breakable commodities, space occupied and weight, whether in car load or less than car load lots and the form in which commodities are presented for shipment. Many other elements might be suggested. When we realize that the system of rate making and method of freight classification are vital to the industrial progress of any community it is evident that boards of railroad commissioners and public service commissions have a difficult and important duty to perform if they are to deal justly with the railroad company on the one hand and the shipper on the other.

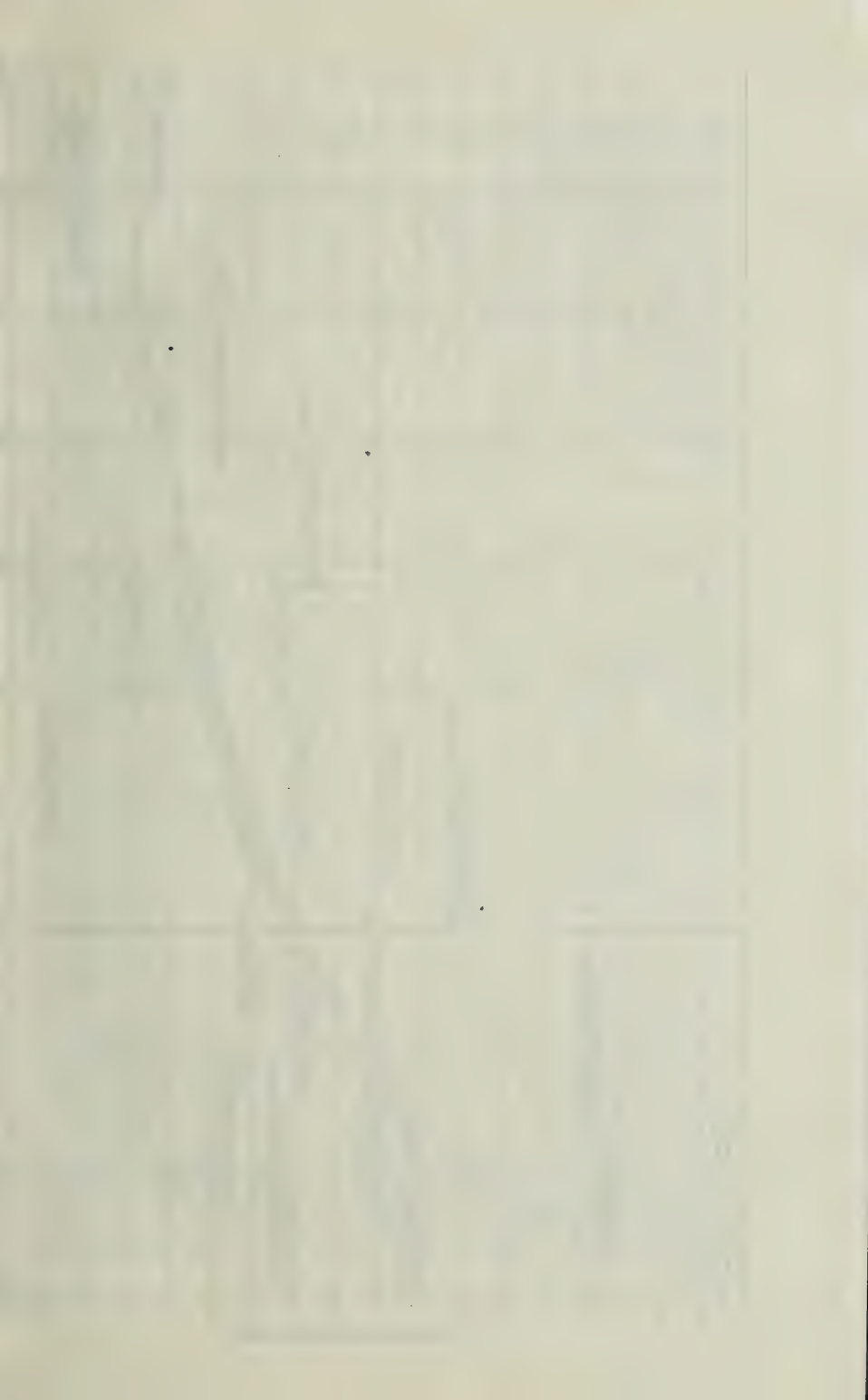
Bearing these facts in mind, it will be interesting to note the views of manufacturers regarding the question of freight rates here in Iowa. Reference has already been made to a manufacturer who informs the writer that "The freight rate from Pittsburgh to Los Angeles is \$16 per ton on steel and the freight from Des Moines to Los Angeles is also \$16 per ton or the same rate as from Pittsburgh. As we have to buy our steel in Pittsburgh, you can readily see that we could not pay \$6.70 per ton for shipping the material from Pittsburgh to Des Moines and then another \$16 per ton for shipping the material from Des Moines to Los Angeles." It will be observed that this fact is the result of the "blanket" system of adjusting through rates from all territory east of the Missouri River to Pacific Coast points.

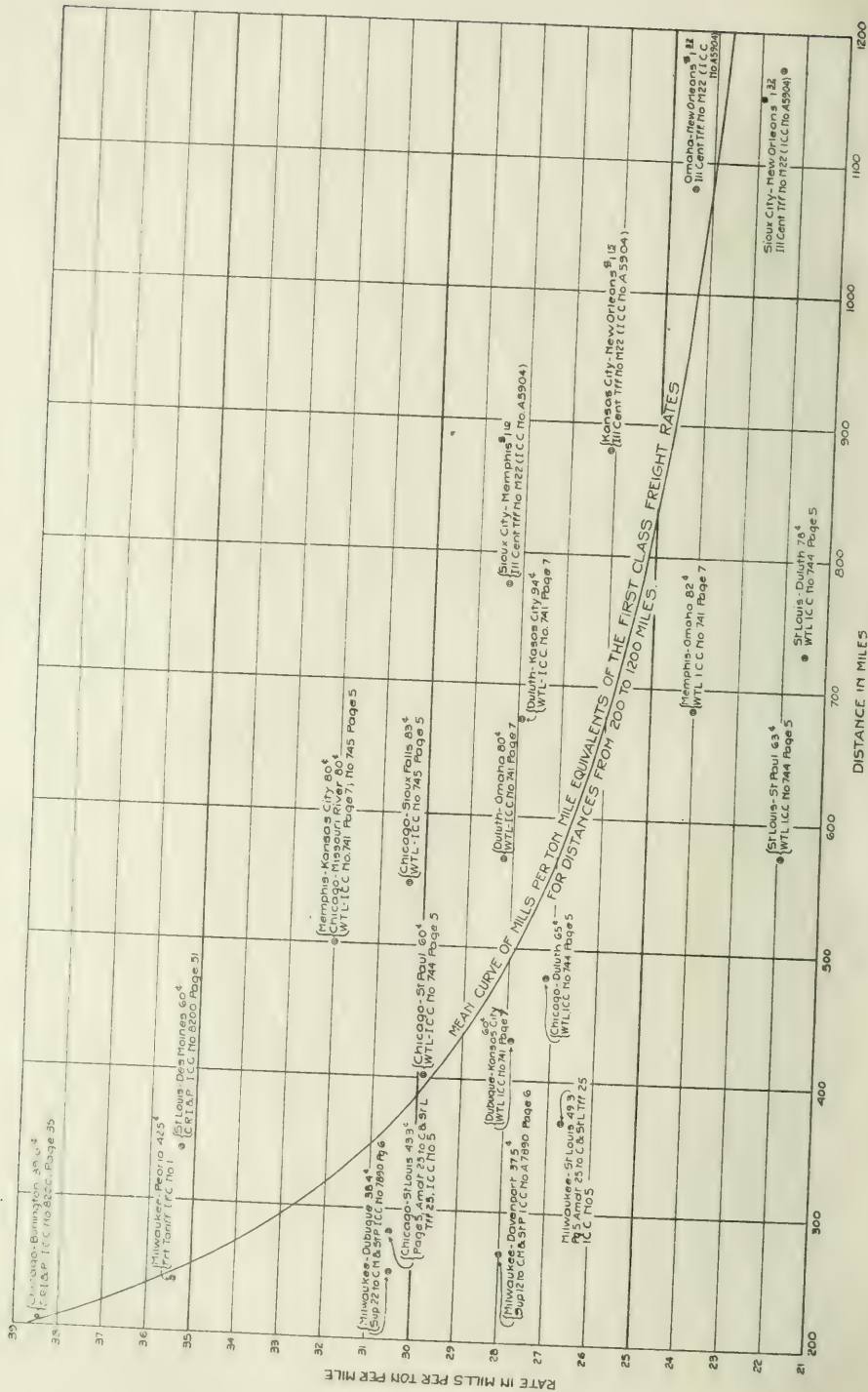
Pertinent to the suggestion already made that the railroads have deliberately adjusted their rates so as to concentrate manufacturing in eastern states, a prominent commercial authority in Burlington assures the writer that, "The policy of the railroads has been to discourage the building up of urban population in Iowa while doing everything to encourage such population in the eastern part of the country. The result has given the railroads longer hauls."

A prominent manufacturer in Waterloo goes to the heart of the difficulty when he suggests that freight rates should be made on a percentage basis. At present we have the complicated system of more or less fixed and arbitrary differentials already noted. He thus writes: "When the time comes that the freight rates will be based upon the mileage and freight from Iowa to the Pacific Coast is perceptibly less than from far eastern points to the Pacific Coast, factories in Iowa will have a better chance to get business."

In making a brief study of the freight rate problem, the writer is under great obligation to Mr. E. G. Wylie, Freight Commissioner of the Greater Des Moines Committee. Mr. Wylie is a recognized authority on freight rates and the following charts, prepared under his supervision and recently submitted to the Interstate Commerce Commission in a case brought before that body by the Greater Des Moines Committee, will present to the reader in concrete form the arbitrary, inequitable and discriminatory character of the present freight rate system in Iowa.

Chart I represents a mean curve of mills per ton mile equivalents of the first-class freight rates for distances ranging from 200 to 1,200 miles. The statistics from which this curve has been computed include twenty-one distinct tariff rates and were tabulated by Mr. E. G. Wylie of the Greater Des Moines Committee. The curve was drawn from computations made by Professor Morehouse, of Drake University, and in being presented in the testimony before the Interstate Commerce Commission, was called the MOREHOUSE CURVE OF MEAN MILLS PER TON PER MILE. In order to make the curve representative in character, the distance and terminals equivalent costs of transportation have been computed for an extensive territory in the Mississippi Valley. The rates embrace the populous state of Illinois between the very large cities of Chicago and St. Louis where the tonnage per mile is heavy and the per capita wealth large. They also include rates in the sparsely settled district of Arkansas between Memphis, Tennessee, and Kansas City, Missouri, a territory very different from Illinois. The region em-





braced by the curve extends north to Duluth, Minnesota, west to Sioux Falls, South Dakota, and south to New Orleans.

Mr. E. G. Wylie states that the Morehouse curve was prepared in order that, "We might have a yardstick with which to measure rates and not be constantly met with the opposition that we ought not to make our contrast with a certain rate because it was an abnormally low rate, or because of some other reason." While it is doubtless true that "the average never happens," in other words, that actual rates will either be above or below the curve of mean mills per ton per mile, it is equally true that a norm or average is always serviceable when we are called upon to judge concerning the reasonableness or discriminatory character of specific rates. Comparison with an average of large groups or classes of rates will carry more weight before any board or commission than comparison with one particular rate.

The so-called percentage system, already noted, which prevails between the points on the Atlantic slope and the Central Freight Association Territory, has frequently been commended by the Interstate Commerce Commission and in fact has been subject to the least criticism of any method of rate making now employed in any section of the United States. In the tabulation of the statistics which form the basis of Chart I, Mr. E. G. Wylie and Professor Morehouse evidently had in mind this percentage system of rate making. According to the so-called McGraham rate system, adopted about a generation ago, the basic or typical rate between Chicago and New York is fixed at 25c per one hundred pounds, which in fact is the rate on sixth class freight between said cities. Of this amount 6c is considered to be the terminal cost at Chicago and New York, the remaining 19c being the distance cost. First-class freight rates being three times as high as this so-called basic or typical rate gives 75c per one hundred pounds, of which 18c is the terminals rate equivalent for Chicago and New York, the remaining 57c being the distance charge.

It is an interesting fact that the terminals rate equivalent of 18c for New York and Chicago is practically the same as the amount (18.03c per 100 pounds) calculated by Professor Morehouse on first-class freight for the territory under consideration. In other words, there is an almost unconscious recognition on the part of carriers of the proposition that, as the distance increases, the rate per ton per mile tends to decrease. The fact that the terminal charge, as a relative part of the cost of transportation, decreases as the distance increases, was recognized by the Interstate Commerce Commission in *Farrar and Co., vs. E. Tennessee, Uc., Ry.* (I ICC R 767) in

the following terms: "It is a very familiar rule in the transportation of freight by railroads and has become axiomatic that while the aggregate charge is continually increasing the further the freight is carried, yet the rate per ton per mile is constantly growing less all the time. In consequence of the existence of this rule the increase of the aggregate charge continues to be less in proportion every hundred miles after the first, arising out of the character and nature of the service performed and the cost of service; and thus it is that staple commodities and merchandise are enabled to bear the charges of transportation from and to the most distant portions of our country."

This being the economic law of transportation cost, it is apparent that the curve of mean mills per ton per mile will necessarily be a gradually descending curve as the distance increases. At a distance of two hundred miles from Chicago, it appears that the total cost of transportation both terminal and distance, is 38.67 mills per ton per mile. At a distance of three hundred miles from Chicago, as indicated by the curve, the cost is less than thirty-three mills per ton per mile. The amount gradually decreases to less than thirty mills at a distance of four hundred miles, about twenty-eight mills at a distance of five hundred miles, less than twenty-seven mills at a distance of six hundred miles until it reaches less than twenty-four mills per ton per mile at a distance of twelve hundred miles.

When we examine the specific rates on first-class freight, we find, as already observed that "the average never happens," in other words, that the actual rates are either above or below what a normal rate should be as indicated by the curve. The rate of 39.6c per one hundred pounds on first-class freight from Chicago to Burlington, Iowa, is very close to an average normal rate, as is also the rate of 42.5c from Milwaukee to Peoria, Illinois. The same is true of the rate of 60c from Chicago to St. Paul, and \$1.32 from Omaha to New Orleans. On the other hand, the rate of 37.5c from Milwaukee to Davenport, 49.3c from Milwaukee to St. Louis, 63c from St. Louis to St. Paul, 78c from St. Louis to Duluth, and \$1.32 from Sioux City to New Orleans are considerably below the curve of mean mills per ton per mile. The rate of 60c from St. Louis to Des Moines, 80c from Memphis to Kansas City or from Chicago to the Missouri River, and \$1.10 from Sioux City to Memphis are well above the average.

Concluding our brief statement regarding the so-called Morehouse curve of mean mills per ton per mile, the reader should keep in mind three important facts as a guide in his

study of freight rates: first, that the number of mills per ton per mile decreases with the increase in distance, as a logical result of the declining relative importance of terminal costs; second, that by having an average or norm of large groups of rates clearly established, one is able to compare a specific rate with said average, which is necessarily more satisfactory than comparing it with another specific rate; and finally, the contrast of specific rates with the average normal rate emphasizes the complete chaos of principle in the present method of rate making.

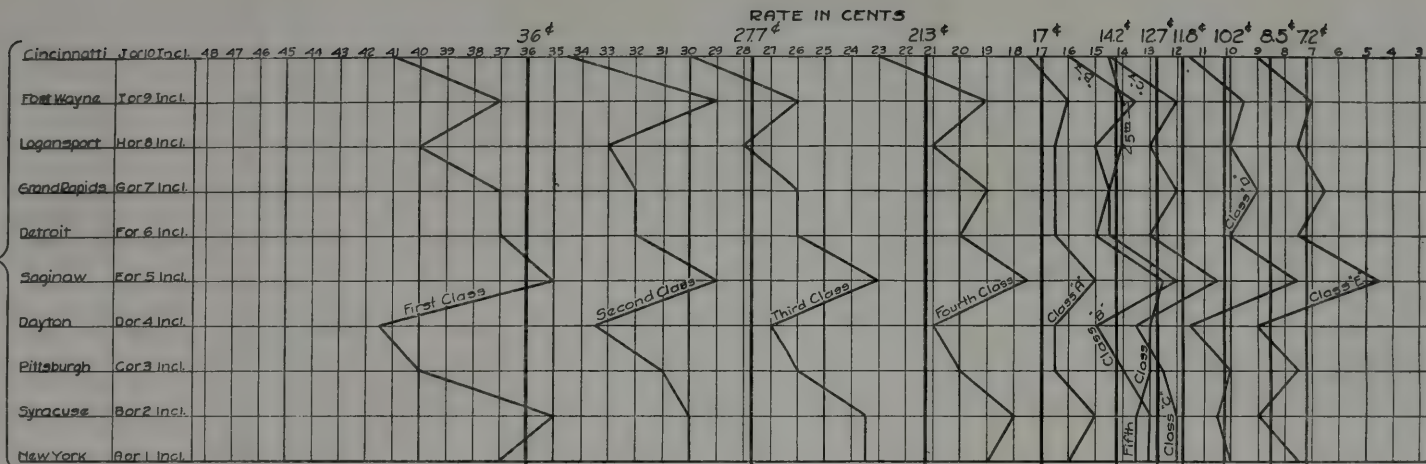
It has already been observed that a freight rate may be too low from the standpoint of reasonable profits or dividends and yet be arbitrary, inequitable and discriminatory in character. In other words, a low rate under certain conditions may be equally as undesirable or even more so than a high rate. This being true, the writer is of the opinion that, when a specific rate varies a large amount either way from the curve of mean mills per ton per mile of the general locality, the burden of proof as to the reasonableness and equity of said rate should rest upon the carrier and not upon the public. If this assumption is correct, Chart I ought to be a real contribution to the difficult and important task of scientific rate making. It certainly represents a great deal of patient and careful labor on the part of Mr. E. G. Wylie and Professor Morehouse, and was one of the most instructive and important exhibits presented to the Interstate Commerce Commission in the recent freight rate hearings at Des Moines.

Chart II represents what has been termed the "saw tooth" system of rate making between Des Moines, Iowa, and Rock Island, Illinois. The heavy horizontal lines represent the voluntarily established intrastate local rates between the two cities, which are as follows: 36c per one hundred pounds for first-class freight; 27.7c for second-class freight; 21.3c for third-class freight and so on for the other seven classes. These rates, being local in character, necessarily include terminal costs both at Des Moines and Rock Island; and therefore should be higher than the amount charged for the same distance considered as a part of a longer haul. Moreover, said local rates, although slightly less than published for that distance as the Iowa intrastate rates, may be considered reasonable as they were voluntarily established and have been in force for nearly a quarter of a century.

The principle that a local rate for reasons already explained should be higher than the amount charged for the same distance, considered as a fractional part of a through rate, has been repeatedly indorsed by the Interstate Com-

From Rock Island to Des Moines

Origin in Group



From Des Moines to Rock Island

Destined Group

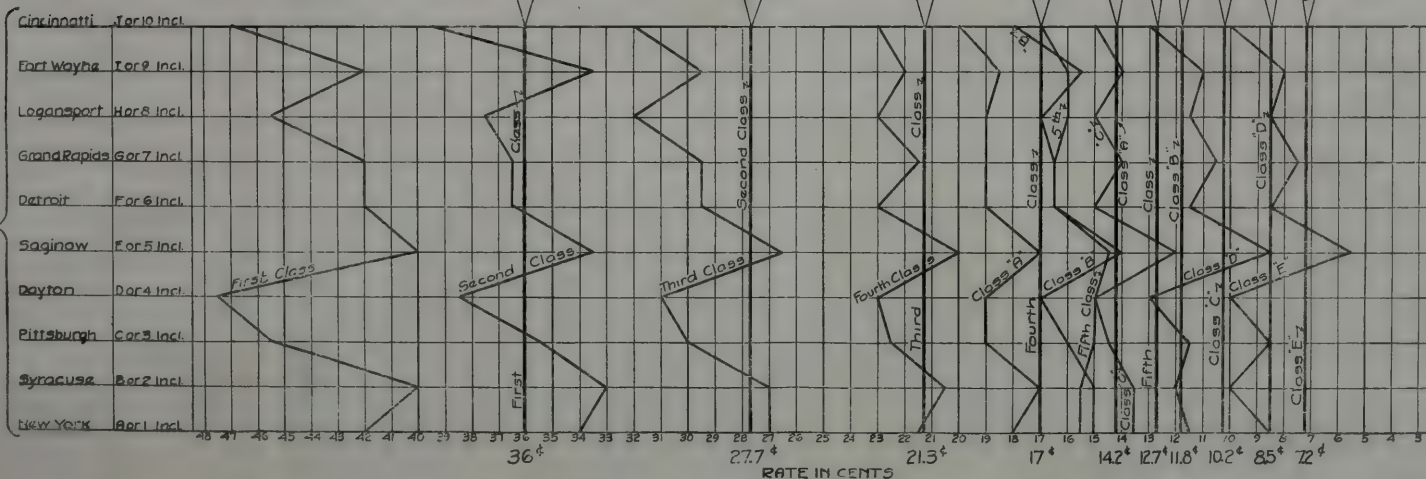


CHART II.

merce Commission. In *Board of Trade of Troy, Ala., vs. Ala., Midland Ry. Co., et al.*, (6 ICC R 23) the Commission said: "A local rate, which presumably is adopted as covering both the initial and final expenses of the haul, is *prima facie* excessive as a part of a through rate over a through line composed of two or more carriers." Again in *New Orleans Cotton Exchange vs. Illinois Central Ry., Col., et al.*, (3 ICC R 534) the same rule was recognized: "A proportion of a through rate charged by one of several connecting carriers, whether it be called an "arbitrary" or a "percentage" may well be considerably less than a local rate charged by the same carrier for the same distance over its line."

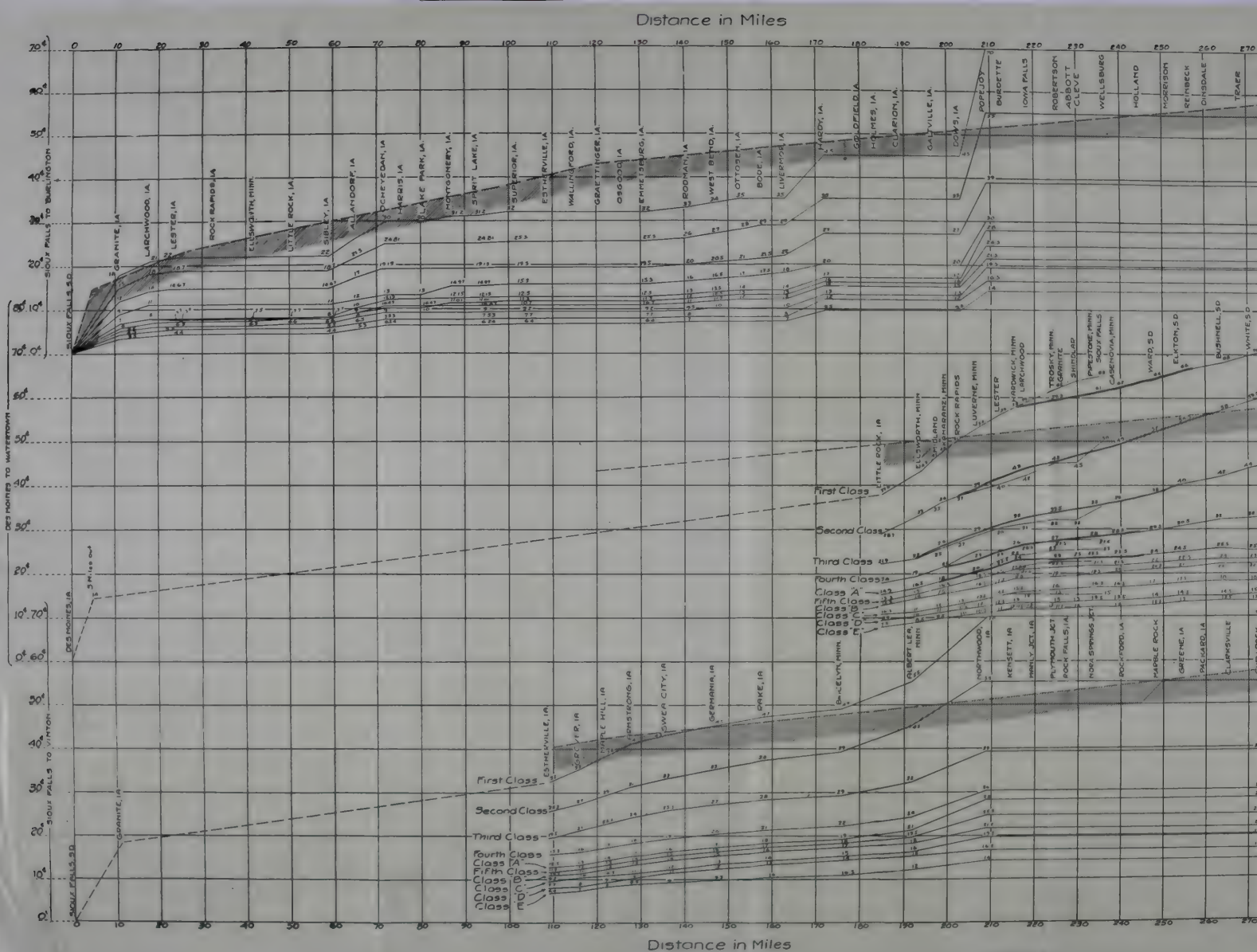
It appears from Chart II that these fundamental principles are being violated by the railroad in question. The left of the diagram is an exhibit of the charges from Des Moines to Rock Island, considered as a part of through rates to the cities indicated. It appears that "the separately established rates" applied to the through transportation for the part of the through rate and service, the so-called proportional or rebilling rate on first-class freight destined for eastern cities is in every instance higher than the local rate between Des Moines and Rock Island. In other words, the local rate from Des Moines to Rock Island on first-class freight is 36c per one hundred pounds, but for this same haul considered as a part of the through service to New York City, the charge is 42c. The so-called proportional or rebilling charge when destined for other eastern cities is as follows: Syracuse, 40c; Pittsburgh, 45.5c; Dayton, 47.5c; Saginaw, 40c; Detroit and Grand Rapids, 42c; Logansport, 45.5c; Ft. Wayne, 42c, and Cincinnati, 47c. It will be observed that the so-called proportional or rebilling charge even for second-class freight is in a number of cases actually higher than the local charge on first-class freight. For example, we note a proportional or rebilling charge of 39.5c on second-class freight, destined Cincinnati in comparison with a local charge of only 36c for first-class freight and 27.7c for second-class freight.

A further study of the chart shows that the same inconsistencies prevail both on east bound and west bound freight for every one of the ten distinct classes. In spite of an act of Congress to regulate commerce which is supposed to prevent rebates and discriminations between shippers, it appears that the so-called "proportional" separately established rates applicable to through transportation radically discriminate between the various localities at which the traffic in question originates or to which it is destined. The exhibit in a word establishes clearly two vital facts: first, that there is a total

lack of system in the adjustment of through rates, which are obviously arbitrary, inequitable and discriminatory in character; and second, the important principle explained by the Morehouse curve that the number of mills per ton per mile decreases as the distance increases is repudiated by the railroads. It is to be hoped that the Interstate Commerce Commission will make impossible such a discriminatory system of freight rates, which in the past has been a great burden to the manufacturer of Iowa and has done much to retard the industrial development of our state.

Chart III represents the system of rate making, which now prevails between Iowa and certain South Dakota and Minnesota points. The upper and lower parts of the diagram are exhibits of rates on freight originating at Sioux Falls, South Dakota, and destined for certain Iowa points. The middle of the diagram represents the various rates on freight originating at Des Moines and destined for Minnesota and South Dakota points. The heavy shaded line represents the interstate rate on first-class freight voluntarily established by the Illinois Central Railroad.

It will be observed from this plat also that there is a total absence of any definite system in the method of rate making. The regularity of the heavy shaded line representing the voluntarily established interstate rates on first-class freight by the Illinois Central Railroad is in striking contrast to the other lines representing the ten different classes of freight shipped between Iowa and certain Minnesota and South Dakota points. On the one hand the reader will note that the rates on first-class freight originating at Sioux Falls, South Dakota, are below the heavy shaded line until we reach Dows, Iowa. If a rate of 35c per one hundred pounds on first-class freight at Livermore, Iowa, is reasonable and at the same time remunerative, then it is difficult to understand why 45c should be charged at Harding, the next station, and 70c at Popejoy. In other words, there appears to be a change from 35c to 70c between the distances of 160 and 210 miles. Beyond Dows, Iowa, it will be observed that rates on first-class freight are above the voluntarily established interstate rate of the Illinois Central Railroad. While rates on first-class freight originating at Sioux Falls, are below the heavy shaded line for a distance of two hundred miles, it is interesting to note that the rates on first-class freight originating at Des Moines are for the most part above the heavy shaded curve after we reach Minnesota and South Dakota points. This being true, the manufacturer and business man in Minnesota and South Dakota can obtain markets in Iowa, but it is rather difficult



for Des Moines on the other hand to secure markets in Minnesota and South Dakota. This plat emphasizes the lack of any scientific basis in rate making on the one hand and on the other hand shows how it is possible to discriminate between cities or even between states in making a schedule of freight rates.

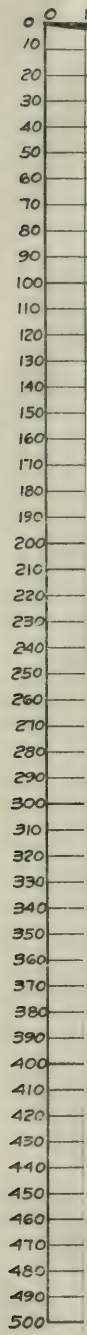
Chart IV is an exhibit of the so-called Iowa Distance Tariff, established about a quarter of a century ago. By distance tariff, we do not mean to exclude terminal costs. The distance tariff, under consideration, which was in a large measure the work of Hon. Peter A. Dey, a civil engineer and at one time a member of the Iowa Board of Railroad Commissioners, includes both terminal and distance costs. As a matter of fact, it is impossible to base freight rates on distance alone; in other words, no tariff can be strictly speaking a distance tariff, if by this we mean that terminal costs are not to be considered.

By reference to the plat, the reader will observe the relationship which exists between the ten different classes in the Iowa intrastate schedule of freight rates. First-class freight is fixed at 100 per cent. The remaining nine classes are varying percentages of first-class. It is an interesting fact that, for the first hundred miles, the other classes are substantially fixed percentages of the first class, the ratios being approximately 85%, 66%, 50%, 35 to 37%, 30%, 25% and 20% respectively. The mathematical symmetry of the tariff for distances up to one hundred miles it is claimed was largely the work of Hon. Peter A. Dey, at that time a member of the Iowa Board of Railroad Commissioners. At distances of more than one hundred miles there is no fixed relationship between the rates charged for different classes of freight; in other words, the tariff is no longer in the same sense a distance tariff.

This departure from mathematical symmetry and substantially a fixed percentage relationship between the classes is thus explained in the report of the Iowa Board of Railroad Commissioners (1888, p. 35):

"One of the earliest duties imposed upon the Commissioners by the law of 1888 was that of making a classification and a schedule of maximum rates. They brought to the consideration of the subject mainly the rates that the railway companies themselves had charged in the past; some of them had been special, some had been made under the influence of strong competition, others were made by an agreement with all the roads in the state and were supposed to represent all the traffic would bear. The Commissioners' rates were as they thought a fair and just average from the comparisons insti-

STATION 100+00



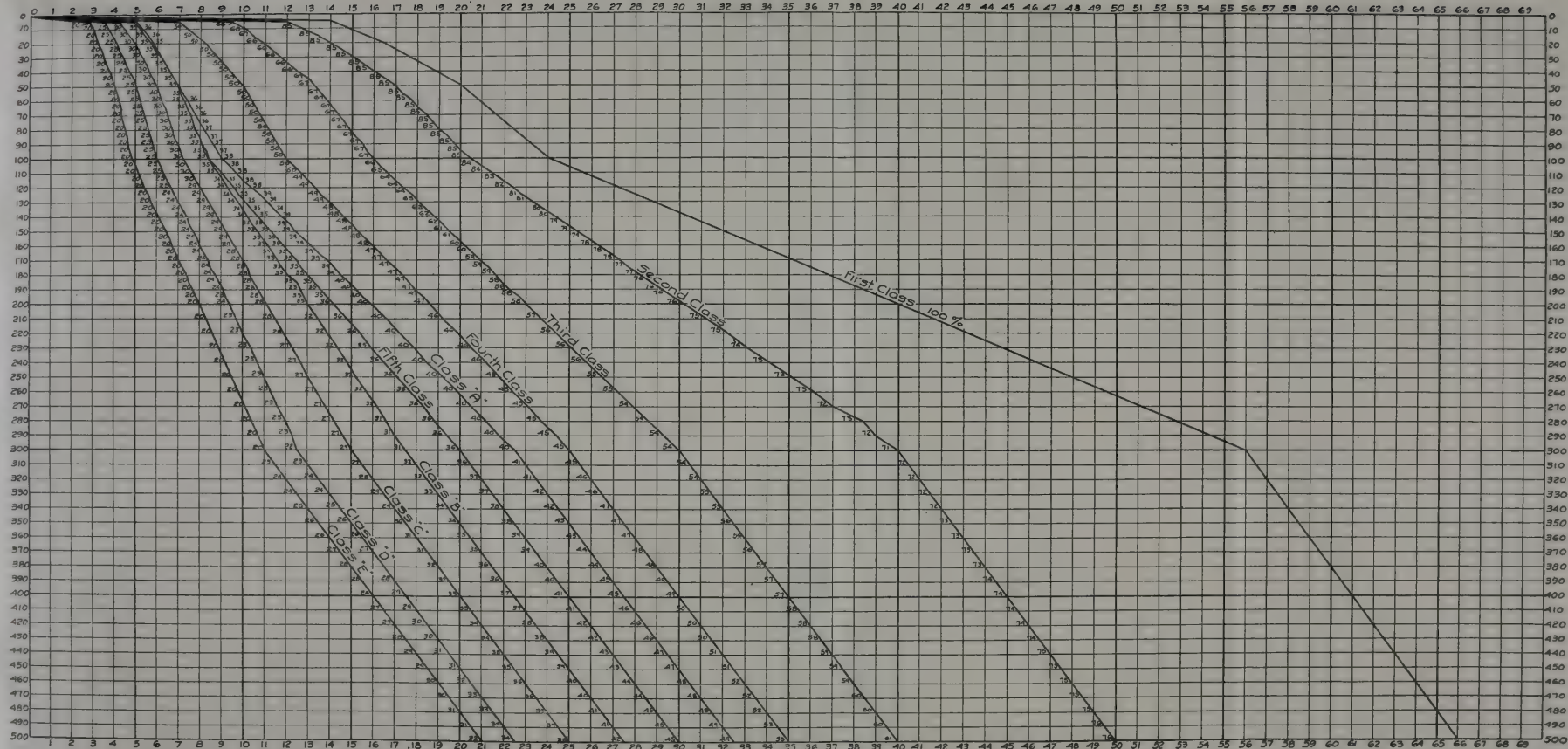
STATION 100+00

DATE

Rate in Cents

Distance in Miles

Distance in Miles



Rate in Cents

CHART IV.

tuted, as the law required, between the rates of this and adjoining states, not always the rates in schedules, but those on which the business had been done. The rates made were intended, as far as practicable, to afford relief to the business interests of the state and at the same time give a reasonable compensation for the service rendered. After having agreed upon them, they were submitted to the general freight agents and in compliance with their request, the rate at three hundred miles was changed to conform to the Missouri river rates. The Commissioners then changed their rates from one hundred to three hundred miles, at the latter distance reaching the rates fixed by the railway companies themselves."

The changes indicated on the plat for distances beyond one hundred miles which were made by the Iowa Board of Railroad Commissioners in order to conform to the Missouri river rates already established by the railroads do not appear to rest on any logical or scientific plan. As already noted, classification should always be made on some reasonable and substantial basis. If the rates given in Chart IV for distances up to one hundred miles rest upon logical premises and are reasonable and at the same time remunerative, then it is difficult to understand why there should be such a departure from the same general plan for distances ranging from one hundred to three hundred miles. The fact that said rates are remunerative was recognized by Mr. Justice Brewer, later of the United States Supreme Court, more than twenty years ago, and the railroads have again and again voluntarily applied them to interstate service.

At least two important conclusions can be drawn from a study of the Iowa Distance Tariff: First, that it is not a distance tariff except for the first hundred miles; and second, that beyond this point there is the same chaos of principle in the rate system we have already observed from the preceding charts. It would seem that freight rates have not been made, but have just grown, like Topsy and the British Constitution.

In concluding this fragmentary reference to the complex and important question of railroad rates, the writer desires to suggest that the subject as applied to Iowa alone demands a volume rather than a bulletin, still less a small part of a bulletin. As stated in the beginning of our consideration of this subject, we must distinguish between discrimination as such on the one hand and earnings or dividends on the other. It may be true that the railroads in Iowa are not earning more than a reasonable profit at the present time. Of this we have no definite knowledge. The fact, however, that there

is almost a complete absence of scientific principles in the rate system, and that, from the standpoint of the Iowa manufacturer, freight rates are arbitrary, inequitable and discriminatory, has long been a matter of common knowledge. Those who hope to make of Iowa a leading industrial state should not underestimate the necessity of securing a just and equitable system of freight rates.

The fourth fundamental of any industrial society is power. In one sense power might have been considered under the heading of natural resources. When we take into account, however, its relative importance and character as a factor of industrial development, it is more convenient to form a separate classification. Other things being equal, an abundance of cheap power is not only an important but frequently a deciding factor. States with a large amount of water power have a definite advantage along industrial lines. The subject, therefore, should receive much more attention in the future than it has in the past here in the state of Iowa.

The problem, however, is very largely, in fact, almost entirely, one of technical engineering. Aside from the general statement already made concerning the economic importance of cheap power, the actual question of power development involves careful researches into the possibilities of Iowa coal on the one hand and a second investigation concerning the water power of the state on the other. Up to date, very little has been done along either line, but investigations are now under way which promise substantial results.

A beginning was made for water power some years ago by Mr. W. L. Foster and Mr. H. J. Gould, who prepared a thesis for the Engineering Division on the subject, "An Investigation of the Development of Water Powers of Iowa." The Iowa State Drainage Waterways and Conservation Commission contains a chapter on "Water Powers of Iowa," which gives statistics regarding water power already developed and that which remains to be developed. A special water power survey was made of the Boone River, but aside from this, funds were not available for carrying on any extensive scientific work.

By far the most important water power, however, which is being developed, is that at Keokuk, Iowa. In fact, when this great dam is once completed, Iowa will have access to the greatest water power plant in the world. The power house will contain thirty turbine generator units, each with a capacity of 7,500 kilowatts, making in all 225,000 kilowatts, or 301,606 mechanical horse power. Of this amount about 200,000 electric horse power is offered for sale and according

to the January number of Iowa Factories, St. Louis has already contracted for 60,000 horse power for 99 years.

When we take into consideration the fact that the latest government census figures credit Iowa with only 100,418 horse power from all sources now used in manufacturing, some definite opinion may be formed concerning the great value of this hydro-electric plant. Keokuk, Ft. Madison and Burlington are already taking an active interest, through their commercial organizations, in the matter of securing a part of this cheap power. Other cities especially in the southeastern and eastern part of the state should follow their example. If proper advantage is taken of this great store house of energy it will be no small factor in making Iowa a leading industrial commonwealth.

The great importance of a thorough investigation of the water power resources of the state is summarized by the Iowa State Drainage Waterways and Conservation Commission (p. 131) in the following terms:

"1. Iowa streams are capable of producing valuable power.

"2. The present power developments of Iowa are but a nucleus of future developments.

"3. It is the duty of the state to either so regulate the development of these powers as to encourage the growth of the industry, at the same time retaining sufficient control over it to insure justice for the people of the state, or to take upon itself the problem of the improvement of our water powers.

"4. The proposition of state water power development and the control of such industry warrents further investigation."

Finally every well-informed person will agree that capital is one of the essentials of an industrial community. An abundance of raw material, cheap power and reasonable freight rates are all very important from the standpoint of the manufacturer, but, cheap money is also one of the fundamentals in building up the commercial and manufacturing industries of a state. If New England manufacturers can obtain all the money they need for 4 and 5% and Iowa manufacturers are obliged to pay 6 and 7%, it is not difficult to see that the Iowa manufacturer is placed at a great disadvantage. This has been, in fact, is the real situation, and constitutes one of the causes that have retarded the growth of commerce and manufactures in this state.

These facts have been suggested in a large number of letters received from Iowa manufacturers. The following statement of

a manufacturer in Sioux City is significant: "Our personal opinion is that the attitude of the Middle West banks and bankers has done more to impede the progress of manufacturing in the Middle West than anything else. Our opinion of the reason why factories do not move westward can be given in three words, 'high-priced money.'"

A very successful manufacturer in Des Moines thus writes: "One thing that Iowa needs is one or more trust companies or banks or whatever you may call them. Such institutions could buy the entire issue of preferred stock of a manufacturing concern." Another gentleman in the same city states: "The most cogent reason we know of why manufacturing establishments do not grow faster in Iowa is the fact that the bankers in the state do not help foster manufactures anything like they do in eastern states."

The fact that New England bankers are willing to loan at reasonable rates to promote manufacturing is mentioned by a number of Iowa manufacturers. The following is typical: "New England bankers and investors are educated in the manufacturing business and understand and appreciate its possibilities, it being a well-known fact that manufacturing is the main stay of New England's vast activities." The idea that capitalists and bankers must be educated along this line is thus expressed by a prominent manufacturer in one of our leading cities: "We heard a resident of Detroit, Michigan, say a short time ago that if you were to go into Detroit with a land deal you would have very little chance for success. However, if you were to go into Detroit with an automobile proposition you would have no trouble in financing the proposition in a few days. This can be explained through the fact that so many people are making money in Detroit from their automobile investments while only a few are making money on their land investments."

A great many manufacturers and commercial clubs deplore the present tendency to invest large amounts of money outside of the state in questionable enterprises. The fact that millions of dollars have annually followed such channels is a matter of common knowledge. Iowa investors have been educated to buy almost anything else except stock in a successful manufacturing enterprise. One writer states: "The western land and the newly discovered oil well have a charm not possessed by a local industry, which offers sure but less wonderful possibilities of profit." Another leading manufacturer emphasizes the same point: "One of the chief troubles to overcome is the fact that our people have been educated to buy banking stock, insurance stock, blue sky in Mexican mines and to deal in real estate. To overcome this they will have to be educated in broad liberal lines that manufacturing

increases the wealth of our cities and towns faster than any other business."

In an excellent leaflet entitled, "Iowa Capital for Iowa Industries," by J. A. Gunn, of Kellogg, a member of the executive committee of the Iowa State Manufacturers' Association, the relative importance of capital as a corner stone of industrialism is well stated. He calls attention to the large amount of money being sent out of the state, year after year, to purchase agricultural implements, shoes, clothing and many other things which can be manufactured quite as well in Iowa as in other states. Mr. Gunn also concludes that enough capital has gone out of the state seeking investment in questionable enterprises, which if properly invested in local factories would have resulted in an increase of Iowa population.

The subject of banking and credit, as related to industrial activity, is one altogether too extensive and complex to be properly treated in a bulletin of this kind. It is a proper subject for more thorough investigation. It would require a monograph to explain the numerous economic problems involved in a study of banks as related to the industries. A series of bulletins or articles dealing with the banking and credit systems of our leading cities would be a great benefit to all those who desire to become manufacturers. The writer would suggest the desirability of publishing brief articles along this line in *Iowa Factories*, explaining exactly how manufacturing has been developed and encouraged by the activity of certain banks and trust companies. In this way the success of one industrial community will be helpful to every other community in the state.

In conclusion it should be stated that of the five fundamentals so-called of a great industrial society—an industrial population, natural resources, transportation, power and capital—the last is by no means necessarily the least important. It would be unscientific to say that any one factor under all conditions is the most important or the least important. The fact is that all are essential. Manufacturers are great borrowers, and from the nature of things must continue to be borrowers, especially in certain lines of industrial activity. This being true, an abundance of cheap money will always be necessary to promote industrialism. It may be safely alleged that the failure of banks to invest liberally in factories and the fact that our people, in general, are not educated along these lines is one of the leading causes which has retarded the growth of commerce and manufactures and therefore partially explains why Iowa has declined in population.

This chapter would be incomplete if the writer failed to make special mention of at least two conditions which have already been suggested. We refer to the present system of taxation on

the one hand and the matter of adverse legislation on the other. Both conditions have been mentioned, again and again, in the letters received from Iowa manufacturers. These conditions affect the industrial development of Iowa in many important ways and are closely connected with one or more of the so-called fundamentals of an industrial society as outlined in this chapter.

A manufacturer in Mason City makes the following instructive reference to the subject of taxation: "The only real legislation accomplished the past winter for the benefit of manufacturing industries was the passing of the five-mill tax levy on all moneys and credits. This will enable some of our local money to remain in the state and thus encourage industrial enterprise." This same thought is expressed in other letters and was frequently suggested at the annual convention of the Iowa State Manufacturers' Association held at Burlington, Iowa, in May, 1911. In this connection, there is some reason to believe that perhaps banks have been condemned a little too severely for not giving more liberal support to the industrial life of the state.

The reader should bear in mind that prior to Jan. 1, 1912, moneys and credits were subject to general property taxation. This means that in the average city of Iowa the tax rate was approximately 2% on full valuation as a logical result of the under assessment of all the remaining property in the state. It will be generally admitted that a 2% tax on moneys and credits, which means the equivalent of an income tax ranging from 33 1-3 to 50% is not taxation, but rather confiscation of property. Such a system of taxation when actually enforced as it was in some localities by the work of the tax inquisitors did much to drive money out of the state, which otherwise might have been used in promoting our industrial growth.

In view of these consideration the rate of five mills on money and credits will no doubt be a helpful factor from the standpoint of the manufacturer who will be able to secure more money and at a cheaper rate of interest. It is a well-recognized economic law that a tax on moneys and credits is shifted to the borrower in the form of higher interest rates. This being true, a flat rate of only five mills should have a tendency to lower interest rates on the one hand and make loanable capital more plentiful on the other. If this is the result, the Iowa manufacturer will receive a great benefit from this very desirable change in our revenue system. Other reforms in the system of state and local taxation might be mentioned. This subject is now being investigated by a Special Tax Commission, which will report to the Thirty-fifth General Assembly.

Little need be said regarding the general subject of adverse legislation. Every person who follows the work of our General

Assembly is familiar with the scores of ill-considered bills, which are introduced and only too frequently enacted into law. If the Iowa State Manufacturers' Association accomplished nothing more than the defeat of large numbers of such bills at each session of the General Assembly, the organization would be rendering a great and necessary public service. It is to be hoped that in the future more care and study will be given to the complex and responsible work of practical legislation.

At the present time a Liability Commission is investigating the question of employer's liability and working men's compensation and will submit a report to the next General Assembly. This report, the one to be made by the Special State Tax Commission, and similar reports submitted from time to time along other lines, should form the basis of sane and constructive legislation. What we need is not agriculture made laws, engineering made laws, trade union made laws, still less laws enacted by special privilege. Legislation at all times should be based upon a careful historical study of our own political and economic development as a state, together with a comparative investigation of the successful experience of other states and foreign countries. In this way, laws will be enacted for the benefit of the state at large, will promote its harmonious development along educational, social and economic lines, rather than build up one industry at the expense of another. While Iowa is a great agricultural state and should promote the cause of scientific agriculture, there is no reason why the same encouragement should not be given to the growth of industrialism. Practical legislation in the future should be broad enough to comprehend the harmonious development of all our diversified resources, which include agriculture, mining, manufactures and commerce.

In conclusion we may state that the conservative generalization so often made and too frequently accepted, that Iowa is essentially an agricultural community and therefore cannot become great along industrial lines is entirely without foundation. The Federal Census of 1910 reveals the fallacy of any political, economic or industrial system which assumes that a state can realize its maximum wealth and population by encouraging the growth of only one of its resources: viz.,—that of agriculture. While the agricultural population of Iowa has declined at least one hundred thousand during the last ten years, in spite of all the money and time given to promote the cause of scientific agriculture, it should not be forgotten that the industrial population has increased more than one hundred thousand in the same period, and that with practically no encouragement from our General Assembly and without the aid of a scientific system of secondary instruction in the industrial and mechanic arts. When we bear

in mind the fact that the product of our factories has increased more than eight-fold in the last forty years as compared with the product of the farms, which has increased about four-fold during the same period, it is difficult to understand why Iowa is not in a position to become one of the foremost industrial states. With an industrial population, made possible by an efficient system of industrial education; with great and diversified material resources, including an abundance of cheap power; with efficient transportation at just and reasonable rates; with a banking and credit system, willing to encourage the development of factories; and with an equitable plan of taxation, a reasonable amount of state pride and patriotism, there is no reason why Iowa should not achieve the same leadership along industrial lines which has already been realized in the field of agriculture.

CHAPTER III.

CONCLUSION.

The statistical study of Iowa population together with a critical analysis of the so called fundamentals of industrialism, has made it possible to draw a few general conclusions regarding the constructive policies, which should be followed in the future. It has been demonstrated conclusively that the problem of increasing the wealth and population of Iowa is simply the problem of how to realize the harmonious development of all our resources. In other words, scientific agriculture must be supplemented by scientific industrialism.

If we are to make Iowa a leading industrial as well as a leading agricultural commonwealth, it is necessary to bear in mind the following vital considerations:

(1). An industrial population is an imperative necessity. No state or nation can achieve leadership along manufacturing lines without an industrial population. This is only another way of saying that a complete system of industrial education is likewise a necessity, which system must comprehend; first, secondary instruction in the industrial and mechanic arts; second, higher institutions of technology or applied science; and third, research and experimental work.

(2) Secondary instruction in the industrial and mechanic arts must be given to the many rather than the few. The artisan class, so called, should be trained by the thousands and tens of thousands and the training must not only be given close to home, but should conform to the particular needs of each locality. In other words, secondary instruction in the mechanic arts cannot be

given at Ames or any other large state school; but, from the very nature of things should become a distinct part of our public school system. As time goes on, separate trade schools, continuation schools, correspondence study and extension lectures, in fact, a diversified system of secondary instruction along industrial lines, will no doubt be established. While it is impossible and impracticable for the thousands of artisans to attend any central state institution of applied science, it is both possible and desirable for the Iowa State College of Agriculture and the Mechanic Arts to assume a leadership in this important field, which can be accomplished effectively in only one way—viz., through a Division of Engineering Extension, which will serve as the cementing principle of a state wide system of industrial education.

(3) A higher state institution of technology or applied science is necessary to develop: first the trained engineer who, under existing conditions, is indispensable to the proper industrial growth of any state or nation; second, experimentalists and research workers, in other words, trained experts who are being called upon more and more in every field of social, political and economic activity; and finally, an efficient corps of instructors and extension workers capable of assuming real constructive leadership in the important field of secondary industrial education. Such an institution, however, cannot perform the maximum service for the state at large along any of these lines except through the principle of Extension.

(4) The great importance of experimental and research work along industrial lines cannot be overestimated. The Engineering Experiment Station is already doing a useful work, and it is to be hoped that the manufacturers of the state will come into closer touch with this work. The Experiment Station has developed along two important lines: first, tests and analyses, and second, technical investigations of one kind or another. The Station is now constantly receiving from cities, counties, corporations and individuals, samples of cement, brick, tile, sewer pipe, asphalt, iron, steel, wood, stone, gravel, sand, clay, cement materials, fuels, water, sewage, and various other materials, with the request that the same be tested or analyzed and the results reported: Dean A. Marston, of the Engineering Division, and Director of the Engineering Experiment Station says that the volume of this work is constantly increasing and that the Station is coming to be considered final authority on questions regarding the quality and value of fuels, clays and other materials. The charge for such tests is only nominal and is intended to cover simply the cost of the work.

It may be said, however, that the main work of the Engineering Experiment Station consists of technical investigations. In

this connection, Dean Marston makes the following statement: "The purpose of the Engineering Experiment Station is: first, to afford a service for the other industries of Iowa similar to that afforded by the Agricultural Experiment Station to the agricultural industries; second, to assist the urban population of the state in solving the technical problems of urban life; and third, to solve the purely engineering problems of the agricultural population and industries of the state."

At the present time a large number of technical investigations are in progress. Among these are to be mentioned: sewage disposal for cities; sewage disposal for private houses; testing of electric lamps; grounding electric wires; heating and ventilating apparatus; Iowa road materials, and concrete and concrete materials. The investigations of Iowa fire clays will no doubt be of great service to the brick and tile industries of the state. The departments of Ceramics and Industrial Chemistry are in a position to render invaluable service to a group of important industries. In a word, there is practically no limit to the amount of useful work which can be done along the line of scientific research and technical investigation.

(5) A thorough and accurate survey of the various material resources of Iowa should be made as soon as funds for that purpose are available. Work along this line has already been done in the case of Iowa road materials, which is practically ready for publication. A series of bulletins outlining the material resources of the state would prove conclusively that Iowa may become great along industrial as well as agricultural lines. The importance of this work is apparent when we consider that the great majority of people and even manufacturers themselves have so generally assumed that Iowa does not possess the material resources demanded by an industrial society.

(6) The important question of power and power development includes a dual investigation: first, of the coal supply, its quality and amount, and second, the water power of the state. This one problem alone opens up a practically unlimited field for careful, scientific work.

(7) Transportation with special reference to just and reasonable freight rates, which has been merely suggested in this bulletin, should be made the subject of more thorough investigation. A series of bulletins of great value not only to manufacturers but to every class in the community, might be published along this particular line. This is the work of the political economist and affords an example of how closely the field of applied economics is related to the field of technical engineering. Iowa should be given a square deal by the railroads and a careful study of the economics

of transportation would be of service in realizing this desirable end.

(8) The banking and credit system, as related to industrial development, is again a question or rather a series of questions in what may be called engineering economics. A bulletin or perhaps even a monograph published along this line would be of practical value to the manufacturers of the state.

(9) If we are to achieve leadership in the industrial and mechanic arts, the necessity of developing a state pride in our factories and the importance of advertising the industrial possibilities of the state cannot be overestimated. This has been done with great success in the older states to the east and there is reason to believe that the same results could be obtained here in Iowa.

(10) Careful scrutiny should always be given to the subject of practical legislation. The work of the General Assembly should be followed by the Iowa State Manufacturers' Association in order to safeguard the industrial welfare of the state. There is room for almost unlimited improvement in our methods of law making along this and other lines. In this connection we have again a large field for historical research and comparative study, which is closely related to the technical problems of engineering and the development of the industrial arts. From every standpoint the study of political science and economics is not only of general but of technical value in connection with all of the so-called technological or applied sciences. Scientific methods and principles are necessary, whether we are engaged in building a bridge, planning a drainage system, testing materials of construction, or drafting a law along the line of employers' liability and working men's compensation. The work of the political economist and the technical engineer are only different sides of the same industrial problem.

From the foregoing analysis, it is obvious that, from whatever angle we view the problem of Iowa industrialism, the necessity of Engineering Extension is apparent. Without such an Extension Division, it is impossible or at least impracticable for the Engineering College at Ames to assume a leadership in the all important field of secondary instruction in the industrial and mechanic arts. In the second place, the principle of Extension is necessary in order to bring the work of the Engineering Experiment Station into closer touch with the actual needs of the Iowa manufacturer. At the present time the average Iowa manufacturer scarcely knows that the Station exists, not to speak of possessing any definite knowledge of its scope and usefulness. An Engineering Extension Division would perform the invaluable service of giving the manufacturer clear ideas regarding the nature and pur-

pose of technical investigation work. In other words, an Extension Division would perform the dual function: first, of connecting the higher institution of applied science at Ames with the actual work of secondary instruction along industrial lines in every part of the state; and second, it would connect the laboratory of the scientific investigator in the Engineering Experiment Station with the shops and factories of the practical manufacturer. As already suggested an Engineering Extension Division would render the same service to the manufacturers of Iowa as the Agricultural Extension Division is now rendering to the farmers of Iowa. In both cases the Extension Division is the cementing principle and gives elasticity, symmetry and vitality to the whole system of education.

BULLETINS OF THE ENGINEERING EXPERIMENT STATION

- *No. 1. The Iowa State College Sewage Disposal Plant Investigations.
- *No. 2. Bacteriological Investigations of the Iowa State College Sewage.
- *No. 3. Data of Iowa Sewage and Sewage Disposal.
- *No. 4. Bacteriological Investigations of the Iowa State College Sewage Disposal Plant.
- *No. 5. The Chemical Composition of the Sewage of the Iowa State College Sewage Disposal Plant.
- *No. 6. Tests of Iowa Common Brick.
- *No. 7. Sewage Disposal in Iowa.
- *No. 8. Tests of Dry Press Brick Used in Iowa.
- *No. 9. Notes on Steam Generation with Iowa Coal.
- *No. 10. Dredging by the Hydraulic Method.
- *No. 11. An Investigation of Some Iowa Sewage Disposal Systems.
- *Vol. II. No. 6. The Good Roads Problem in Iowa.
- Vol. III. No. 1. Tests of Cement.
- Vol. III. No. 2. State Railroad Taxation.
- *Vol. III. No. 3. Steam Generation with Iowa Coals.
- Vol. III. No. 4. Incandescent Lamp Testing.
- *Vol. III. No. 5. Steam Pipe Covering Tests.
- *Vol. III. No. 6. The Assessment of Drainage Districts.
- Vol. IV. No. 1. Tests of Iowa Limes.
- Vol. IV. No. 2. Holding Power of Nails in Single Shear.
- Vol. IV. No. 3. Miracle Contest Papers for 1908.
- Vol. IV. No. 4. Miracle Prize Papers for 1909.
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